

**A SCALE-FREE, RELATIONAL APPROACH TO SOCIAL DEVELOPMENT IN LATE-
PREHISTORIC TYRRHENIAN CENTRAL ITALY**

by

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ABSTRACT

This dissertation examines the interplay between relational patterns and trajectories of social development within late-prehistoric Tyrrhenian Central Italy (TCI). Despite historical disagreement, TCI is now recognized as a context of radical social transformations leading to or even encompassing the formation of states and cities. Between the end of the Bronze Age and the Early Iron Age (12th-8th centuries BCE), in concert with substantial changes attested in the funerary record, hundreds of small settlements distributed evenly across the research area were replaced by a few large and formally heterogeneous centers. Based on a narrow evidentiary range, these developments tend to be viewed in terms of differential progression along a single axis of complexity, with the emerging centers categorized according to apparent scale and historical prominence.

The aim of this work is not to establish TCI as a case of state formation and urbanization according to one or another definition. Following anthropological perspectives that emphasize the importance of parsing the dynamics underlying qualitative changes in the form of social collectives, I focus on tracing developmental trajectories within a systematically validated relational plane as a first step toward identifying better bases for comparison, categorization, and ultimately explanation. In practice, I derive large datasets for network reconstruction from the TCI mortuary record and apply tools developed for the study of complex networks to track the position of social collectives over time and extract summary measures of relational distance. I use these measures to evaluate three aspects of the transformations attested between the end of the Bronze Age and the Early Iron Age: 1) the degree of local and regional coordination involved in the shift from a large number of small villages to relatively few large centers; 2) the impact of shifting axes of long-distance exchange on local relational patterns; and 3) the relationship between the formal characteristics and internal substance of the new settlements. I conclude that the watershed changes attested across the research area can be understood in reference to uniform endogenous processes leading to the emergence of comparable social collectives.

CHAPTER 1: GENERAL INTRODUCTION

This dissertation examines the interplay between changing relational patterns and trajectories of social development within Tyrrhenian Central Italy (hereafter TCI). During the late-prehistoric period, TCI underwent substantial transformations culminating in the emergence of large social collectives—according to some, the earliest states and cities in this part of Europe. In this chapter, I explain what I mean by ‘relational patterns’, why it can be informative to consider their relationship to conventionally emphasized indicators of social development, and why TCI is an interesting context through which to pursue this line of inquiry.

Discussions of the development of large social collectives often assess social complexity as a categorical property, which constrains the potential of both synchronic and diachronic comparison and precludes dealing satisfactorily with superficially ambiguous contexts. Building on statements of this problem in the archaeological literature and calls to approach social complexity as multidimensional, I propose that it might be useful to develop frameworks that can support direct comparison of dynamics within and between social entities regardless of apparent scale (section 1). Appropriate models and techniques to engage in scale-free, relational comparison can be derived from recent research on complex networks, and I argue that deeper engagement between this developing field and archaeology would be mutually beneficial (section 2). Finally, in section 3 I introduce TCI as a suitable context for carrying out this research, focusing on major interpretive trends and the available lines of evidence.

1. STATES, CITIES, AND THE PROBLEM OF SOCIAL COMPLEXITY

Within archaeology and anthropology more broadly, it has become difficult to discuss the emergence of large social collectives from a comparative perspective (cf. table 1.2 at the end of the chapter for definitions of ‘social collective’ and other key terms). Labels such as ‘state’, ‘city’, and ‘polity’ have been trivialized by a proliferation of definitions (concerning the breadth and ambiguity of the terms of the debate, see Finley 1977; Flannery 1998; Scheidel

2013; Yoffee and Terrenato 2015; regarding specifically the relationship between states and cities, Fox 1977; Marcus 1998; Hansen 2000, 2002; Trigger 2003:92-141; Cowgill 2004; Yoffee 2004:42-90; Marcus and Sabloff 2008). In the case of archaeology, which seems to have been left in a state of wary neutrality in the wake of the intense theoretical debates of the 1980s and 1990s (more optimistically, theoretical ‘plurality’; cf. VanPool and VanPool 1999; Hegmon 2003), attempts to let comparative approaches to state formation, urbanization, and related topics out of the disciplinary closet to which they have increasingly been confined require expiatory preambles and disclaimers:

This book can, therefore, be seen as an example of [...] ‘archaeologies of sovereignty’. [...] This perspective differs from archaeologies of the state, in that it seeks always to disaggregate and disassemble sovereignty in order to keep visible how it is made. At the same time, [...] it recognises a general phenomenon that can be fruitfully discussed in relation to a number of distinct cultural and historical contexts (Routledge 2013:158)

This unease may in large part stem from the fact that that states and cities are frequently treated as embodiments of social complexity (Crumley 1995; more broadly, Yoffee 1993; McGuire 1996; Chapman 2003). Though seldom defined, within archaeology ‘social complexity’ is usually understood to refer to the degree of social differentiation and hierarchical organization characteristic of a given context. Qualitative and quantitative approaches for evaluating complexity more abstractly abound in information theory, computer science, and related fields, but it is not always straightforward to determine which definition might be most appropriate in terms of the phenomena and questions being considered (cf. the involved discussions in Cowan, Pines, and Meltzer 1994, which collects transcripts of a seminal workshop on the state of complexity research held at the Santa Fe Institute).

At the most general level, ‘complexity’ must refer to the ways in which relations among the components of a system are configured. Accordingly, given that individuals, families, larger corporate groups, and other social entities tend to be embedded within a broad range of relational planes, it seems clear that social complexity should be understood as multifaceted (cf. Yoffee 1993:7). As larger aggregates are considered, however, it can become correspondingly more difficult to resolve patterns within different relational planes, so that complexity may appear less rugged overall or even to boil down to a few essential organizational features. In this sense, it is not surprising that it is often recast as an inherent quality of large-scale social collectives—

capital-C ‘Complexity’.

The problem of states, cities, and social complexity highlights the importance of pursuing comparative understanding of social collectives not in terms of potentially scale- and context-dependent formal categories but rather by tracing developmental trajectories within multiple relational planes (cf. relational versus institutional approaches within sociology; Bernardi, González, and Requena 2007:166; as discussed in table 1.2, the positional perspective and ‘Blau space’ may provide especially good parallels; e.g., Blau 1977, 1980, 1994; McPherson and Ranger-Moore 1991; McPherson 2004). These arguments are far from novel, especially when viewed in the context of a broader reaction against categorical thinking within archaeology:

The important point is that archaeologists need to consider all strategies of resource mobilization in their political analyses. [...] archaeologists should focus on defining the matrix of these relationships rather than ascribing primacy to any one dimension of economic activity (Hirth 1996:226)

In attempting to treat complexity as a single underlying dimension we are scattering our seed on barren ground. Instead, we should be monitoring social and economic organization as a series of interdependent dimensions [...] [This would allow] the process of social change to be viewed as a truly multivariate phenomenon, rather than as a ‘by definition’ change of state from one to another ‘ideal’ social type (O’Shea and Barker 1996:16)

in this ‘experimental perspective’, it is less important to establish what was a state and what was not a state (or whatever structure is of interest) and more important to precisely characterize the organization of successive efforts to build successful political or social formations, and the factors that led to failures and successes (Wright 2006:316)

In line with such perspectives, I am not concerned about whether TCI encompassed the development of states and cities according to one or another formal definition. This is not because I am opposed to categorization and comparison. Rather, I want to explore techniques to trace the development of social collectives within well defined and systematically validated relational planes from the bottom up precisely because I think they may lead to better bases for comparison, categorization, and ultimately explanation.

As argued in section 1.3 and the following chapter, late-prehistoric TCI represents a good case study to evaluate this perspective. Between the end of the Bronze Age and the Early Iron Age, in concert with substantial changes attested in the funerary record, hundreds of small settlements forming a relatively homogeneous system were replaced by few large and formally differentiated

centers. Based on a narrow evidentiary range, these developments tend to be characterized in terms of differential progression along a single axis of complexity. Accordingly, in order to evaluate existing reconstructions of developmental trajectories within TCI, I will 1) identify and validate a relational plane suitable for tracing dynamics within and between social collectives regardless of apparent scale; 2) map changes in the relative position of collectives within this plane over time and extract summary measures of relational distance; 3) use these measures to evaluate expectations concerning the degree of local and regional coordination at the root of the process of settlement reconfiguration, the impact of shifting patterns of long-distance exchange on individual trajectories, and the relationship between the formal characteristics and internal dynamics of the new centers. In the following section, I discuss the theoretical foundations of this approach.

2. RELATIONAL FIRST PRINCIPLES

A principal aim of this dissertation is thus to adopt a scale-free, relational approach for evaluating developmental trajectories—one that can be applied to social collectives regardless of any preconceptions concerning the distinctiveness, number, or other properties of their constituent entities. One of the difficulties inherent in pursuing such a perspective is that anthropologists and other social scientists have formulated many nuanced conceptual frameworks to describe and analyze relational phenomena. Even during phases of social-scientific thought concerned with working out first principles, it turned out to be very difficult to agree on the meaning of concepts such as social dynamics and social structure, social form, social organization, social process, and social system (e.g., Radcliffe-Brown 1940, 1957; Parsons 1951; Lévi-Strauss 1953 and 1967), let alone describe satisfactorily their relationship to culture or individual agency (Kroeber and Parsons 1958; Giddens 1976). A broadly acceptable theory of relations never emerged, and components of competing approaches were incorporated into frameworks such as actor-system dynamics, eventful sociology, and exchange theory (e.g., Blau 1964; Homans 1964; Emerson 1972; Baumgartner et al. 1986; Sewell 2005).

I find it useful to think of the intrinsic embeddedness of social entities within multiple relational planes as generating forces of attraction and repulsion that shape the trajectories of collectives. In more concrete terms, the enactment of a given transaction can not only establish or alter the

intensity of connections between the entities involved but also preclude the realization of other transactional possibilities, engendering complex feedbacks between dynamics of and on a system (cf. Blonder et al. 2012; further discussed in table 1.2). This view stems from the abstraction of social phenomena in terms of networks of interaction, which is a common thread linking most considerations of relational first principles. Durkheim, Malinowski, Simmel, Tönnies, Weber, and other foundational figures all anticipated modern network approaches. The history of the introduction and dissemination of network thinking within the social sciences has been discussed extensively in recent years, so I do not review it in depth (see Freeman 2004; Pescosolido 2007; for anthropology, Wolfe 1978, 2011; for archaeology, Brughmans 2010, 2013). In the case of the formation and operation of states and cities, the influence of network thinking can be traced from the systems perspectives of the 1960s and 1970s, which relied at least qualitatively on network concepts (e.g., Adams 1966; Flannery 1972; Wright 1977), to recent discussions grounded in quantitative measures of network properties (e.g., Mizoguchi 2009; Neal 2013; Sabloff and Cragg 2015).

Abstract notions about networks of interaction were operationalized relatively early. Beginning in the 1930s, pioneers in anthropology, psychology, sociology, and related disciplines developed increasingly specialized tools to map interactions among social entities (e.g., Moreno 1934; Moreno and Jennings 1938; Jennings 1943; cf. the notion of “relational analysis” in Radcliffe-Brown 1957). Owing to this disciplinary diversity, modern social network theory encompasses a wide field of approaches. The most commonly practiced is perhaps the local or ego-centered approach, which involves inferring features of network topology based on the position and character of select nodes (Pescosolido 2007:215-216). For example, a routine application might rely on measures of the relative centrality of nodes in terms of the number of connections they exhibit or their position along variously determined network paths.

Perhaps more than any other theoretical and methodological framework developed within the social sciences, social network analysis, or SNA, has had a significant impact on other fields. Over the last two decades, as adoption of the Internet elevated the study of connectivity to a matter of national security and corporate success, mathematicians, physicists, and others recognized the value of SNA and incorporated aspects of it into a growing arsenal for studying networks of unprecedented size and articulation. Much of the vocabulary and some techniques

developed for the analysis of social networks have thus transcended their disciplinary roots. While partially influenced by social network perspectives, however, research on ‘complex networks’ tends to ask different questions and use different methods to answer them. In particular, the study of graphs often several orders of magnitude larger than those routinely considered through SNA necessitated a shift in analytical focus from the character of individual ‘actors’ and their ‘ties’ to overall statistical properties (Newman 2003:169; cf. Watts 2004; for a sociologist’s view of the relationship between complex network theory and SNA, see Freeman 2008).

In this context of disciplinary exchange, the study of social networks generated on the basis of archaeological data stands at a crossroads. The field’s roots lay out a clear path leading to SNA for archaeologists interested in understanding their data relationally. Consequently, it is not surprising that a majority of archaeological publications that engage network theory conceptualize nodes at various scales—households in a settlement, sites in a region, etc.—as social actors and proceed to measure their relative centrality and other properties (e.g., many of the contributions in Knappett 2013, which collects applications of network approaches to a wide variety of disciplinary foci within archaeology). Some archaeologists, however, have begun to argue that it may be productive to move beyond the confines of conventional SNA:

Initial attempts to adapt methods from [SNA] to archaeological data have, however, struggled to produce decisive results. [...] the archaeological study of communication networks in the past calls for radically different analytical methods from those employed by most other forms of [SNA]. The fragmentary archaeological evidence presents researchers with the task of reconstructing the broken links of a ruined network from observable distributions and patterns of association in the archaeological record. In formal terms this is not a problem of network analysis, but network synthesis: the classic problem of cracking codes or reconstructing black-box circuits (Sindbæk 2013:71)

I am also convinced that making the most of archaeological datasets will require moving away from the ‘actors/ties’ perspective, but I do not think that the problem arises from some inherent deficiency of archaeological data. This is an old debate, and delving into it would be outside the scope of this section (for the foundations of the debate, see Wobst 1978; cf. Redfield 1960; Heider 1988). Nevertheless, some network-specific observations seem warranted. Although social entities can interact in different ways, resulting in a multifaceted relational space, SNA tends to proceed from single, tidy graphs (cf. Newman 2003:169-171). Like any other model,

networks of this sort can be useful as abstractions of otherwise intractable real-world phenomena. When nodes stand for actual individuals, however, it is easy to forget that a network is a representation and that its topology ultimately reflects choices made at the stage of data collection and preparation. Despite this illusion, ethnographic and sociological data are far from unproblematic for network analysis (see Newman 2010:36-62 for a critical assessment of common SNA datasets).

In any case, the perceived problem of missing data is not as relevant when focus is shifted away from individual actors in order to deal with large networks. Using tools developed for the study of complex networks, it is possible to move fluidly from one level to another of a system (e.g., by means of computational techniques for the detection of topological communities; cf. table 1.2). Jumping to a higher scale of agglomeration or abstraction, what may have appeared as a clearly delineated network will be revealed as a nested component of a larger whole: “At each level [in a hierarchy of systems] there are different systems, in some cases billions of systems, and each of those systems is a network. And the whole is also a network, a network of networks” (Wolfe 2011:9). Nodes at a given level of a large network can thus be analyzed systematically both as collections and components of nodes at lower and higher levels, respectively. Even if the data encoded at the base of a network are unsuitable for deriving precise local measures, the articulation and composition of higher-level topological groupings may capture key information about a system. In fact, as discussed in section 2.3, ‘fuzziness’ at higher levels can be exploited to produce more reliable snapshots of lower-level connectivity.

Overall, then, the problem is not so much that archaeological data are inadequate for SNA, but that most aspects of conventional SNA are not well suited to exploring complex phenomena. The process of obtaining data by questioning ‘social actors’ or documenting interactions as they are occurring or shortly after the fact simply feeds the illusion that it is possible to isolate some sort of essential connectivity or otherwise produce a complete description of the relational bases of a given phenomenon. Regardless of whether this assessment is accepted, I think it is easy to see that the statistical approaches of complex network theory provide a very good fit for archaeology, and archaeology in turn can contribute to this exchange on at least four fronts:

i) Archaeological data represent an ideal testing ground for the computationally sophisticated

analytical tools and models developed to study complex networks over the past two decades. In an early review of the state of the field, one of the pioneers of the “new science of networks” remarked that the underrepresentation of social network data in the expanding corpus of relevant studies could be attributed to “the difficulty inherent in recording social interactions on a large scale” and proposed that the increasing pervasiveness of the Internet as a venue for social interaction might help overcome the problem “at least partially” (Watts 2004:253). This prediction has certainly been validated, but archaeology can become just as important a source of large datasets. As discussed in the next point, moreover, fully engaging archaeological data may prove to be a complete rather than partial solution.

The existing archaeological literature constitutes a virtually bottomless well of relational information, and additional data can arguably be collected in a more controlled way than possible when sampling living populations. Archaeological datasets most often encode traces of countless interactions among unspecified individuals. Again, aggregate data do not pose a problem for the application and further development of complex network approaches, and in any case resolution can be as fine as determinations of individual mobility histories (such as may be obtained from isotopic studies of human remains; see sections 1.4 and 7.1).

It may be worth considering an example of a modern dataset that presents clear parallels to archaeological material. Connections between academic papers are often used to examine the production of scientific knowledge. Frequently, available databases for network reconstruction do not encompass all of the literature cited by the papers they contain or the entire output of any given author, among a host of other biases that have long been recognized (e.g., de Solla Price 1965; Seglen 1992). The analogy between papers as objects with involved production and use-histories, journals as multiphase sites, disciplines as more or less sharply bounded communities, and so on could be pursued at length, but the point is that the approximate character of a dataset does not constitute an insurmountable or even major obstacle. Databases of academic papers became a major source of inspiration for and were successfully examined through complex network approaches and their immediate precursors (e.g., Redner 1998; Newman 2001a; Boccaletti et al. 2006:80).

- ii) More than just suitable for their application, archaeological datasets are necessary for the

continued development of complex network approaches because they provide a window onto the full range of relational forms that have characterized the human experience. Some of these relational forms may still be observed in the present, but far more may have been confined to specific spatiotemporal contexts or may be more difficult to document within living systems. To introduce an analogy developed in the following chapter, if one of the promising aspects of complex network theory is that it can help parse social dynamics in the same way as other types of relational phenomena, as is often stated or implied, then leaving archaeology out of the picture or privileging modern datasets would be akin to limiting astrophysics research to Earth-bound phenomena.

- iii) The previous points should not leave the impression that the role of archaeologists in this exchange would be limited to providing access to data (cf. Yoffee 1993:16). For reasons ranging from the perceived irreproducibility of the archaeological process to the notion that inquiry into past social systems should proceed from the same sorts of questions asked by anthropologists, sociologists, and/or historians, few disciplines have been so deeply concerned with the nuances and potential pitfalls of inferring relations from multivalent data. Awareness of the potential ambiguity of data, which has made some archaeologists altogether distrustful of quantitative approaches, can be instrumental in evaluating the many assumptions that underlie any exercise in network reconstruction.
- iv) Archaeologists are also primed to consider issues connected to diachronic change, which have long been neglected within network perspectives. Conventional SNA simply has not seen the rise of consistent, widely accepted frameworks to accommodate temporal variability, though this may change as sociocultural anthropologists and sociologists begin to consider time more systematically (e.g., Steinmetz 2007; Shryock and Smail 2011). The state of affairs is only slightly better in the case of research on complex networks, which for the most part has noted but not addressed the importance of feedbacks between dynamics of and on networks (i.e., changes in topology versus changes in node states). In recent years, however, this problem has attracted increasing attention, and promising conceptual and methodological tools have been proposed (e.g., Gross and Blasius 2008; Gross and Sayama 2009; Blonder et al. 2012; Sayama et al. 2013). Given that understanding patterns of diachronic development is the bread and butter of the field, archaeologists could contribute to

moving research beyond the ‘dynamics of networks/dynamics on networks’ impasse.

This section supplied the general theoretical context for a scale-free, relational approach to the comparison of developmental trajectories. Before moving on to how such a framework can be put into practice, I conclude this chapter by introducing TCI as a suitable case study. The purpose of the following section is to sketch major interpretive trends and the outlines of the evidence. Specific bases for network reconstruction are discussed in chapter 2, while profiles of the evidence from individual spatial subsets of TCI are supplied in the phase-specific chapters (4-6).

3. RESEARCH CONTEXT

Despite a promising phase of disciplinary interaction in the late 19th and early 20th centuries, contexts even only on the chronotopic fringes of the ‘Classical World’ have been excluded from serious consideration in comparative archaeological frameworks, and in turn researchers interested in such contexts have tended to dismiss models and insights from comparative work. This phenomenon can be ascribed to a variety of factors, but ultimately it is connected to the centrality of the perceived ‘classical heritage’ within Euro-American idealist, colonialist, and nationalist worldviews from the Renaissance to recent decades, if not the present (cf. Humphreys 1978; Terrenato 2002, 2005; Dietler 2005).

TCI is one such context. Geographically, it comprises the areas on either bank of the Tiber, from the coast to the Apennines (fig. 1.1). In terms of later historical designations, the region immediately north and west of the Tiber corresponds to southern ‘Etruria’, while south and partially east of the river is ‘Latium vetus’ (for convenience, I will refer to ‘northern’ and ‘southern’ TCI). Chronologically, the context spans the final stages of the Bronze Age and the Early Iron Age, which according to conventional dating correspond roughly to the 12th-8th centuries BCE (table 1.1; in order to avoid ambiguity, Italian abbreviations are used throughout the remainder of the work).

From the perspective of the intellectual threads that led to the disciplinary isolation of classical archaeology, assessing the character of this context was particularly important. Over the course of the PF, TCI supposedly witnessed the initial bestowal of ‘civilization’ from ‘Greece’ to

‘Rome’, with variously defined ‘Etruscans’ often posited as intermediaries:

in southern Etruria, in Latium, and likewise on the east coast, peaceful intercourse with the [Greek] merchants was protected and encouraged [...] These cities, where the Italians held peaceful sway and carried on friendly traffic with the foreign merchant, became preeminently wealthy and powerful, and were genuine marts not only for Hellenic merchandise, but also for the germs of Hellenic civilization (Mommsen 1888[1854]:193-194; cf. Niebuhr 1831[1812]:131)

FIGURE 1.1 Location of TCI within Italy and detail illustrating major historical sites and ethnolinguistic regions (Boatwright, Gargola, and Talbert 2004, backpage).

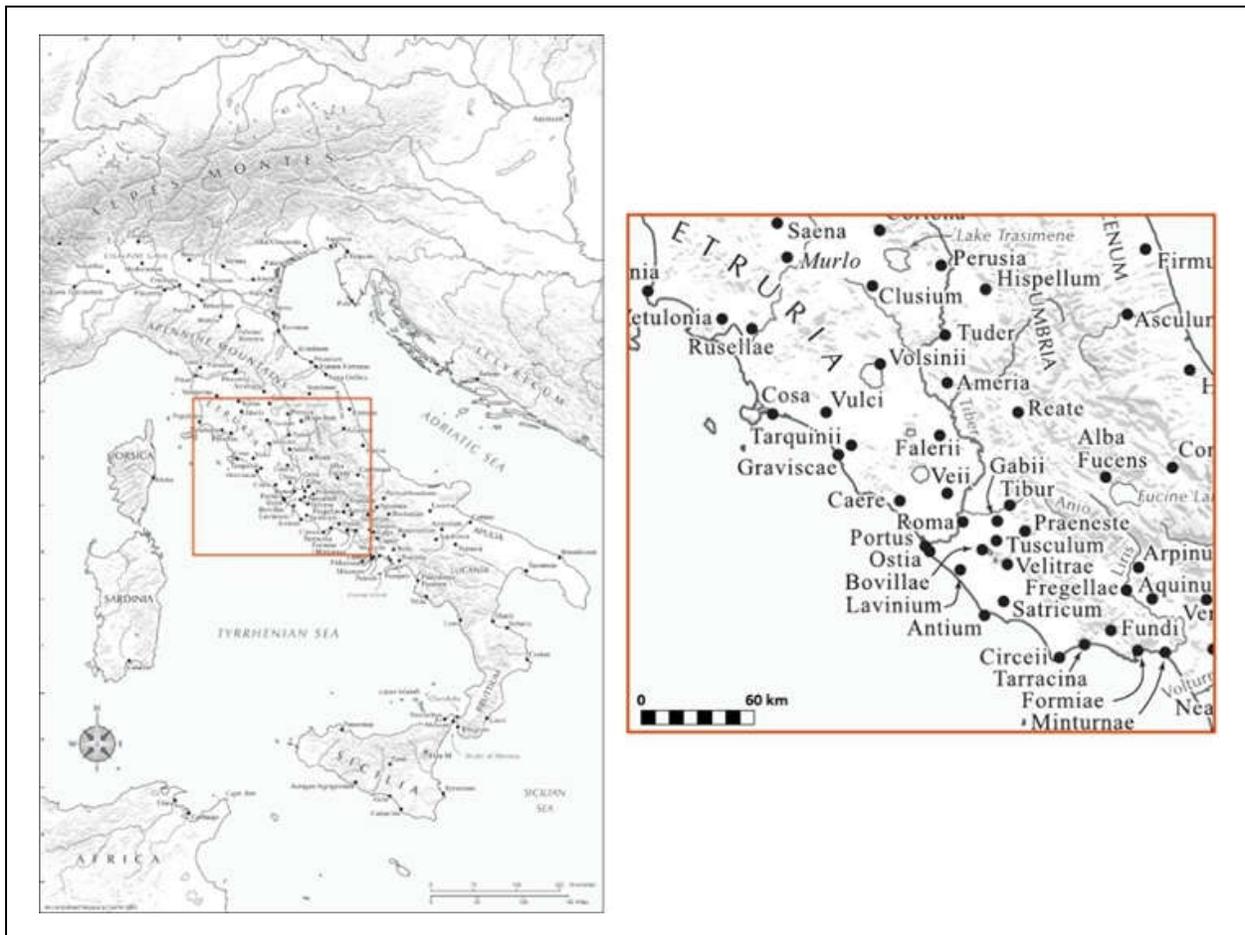


TABLE 1.1 Traditional chronological subdivisions and abbreviations (see section 2.3 and fig. 2.8 for a more detailed exposition).

Period	Phase	Abbreviation	Chronological span (centuries BCE)
Età del bronzo finale/Terminal Bronze Age	1-2	BF 1-2	12 th -11 th
	3	BF 3	11 th -10 th
Prima età del ferro/Early Iron Age	1	PF 1	9 th -8 th
	2	PF 2	8 th

Nevertheless, early attempts to organize and interpret archaeological material from TCI were not guided exclusively by classical traditions (e.g., Pigorini and Lubbock 1869; Pinza 1898). The researchers who undertook them were first and foremost anthropologists (e.g., Pigorini 1871; Pinza 1897). They were anthropologists of their time, however, which means that they also operated within an idealist framework of cultural progression. As the evidence at their disposal essentially amounted to traces of a few huts and idiosyncratic burials, they reconstructed modes of subsistence, ritual, and social organization rooted in contemporary ideas about ‘primitivism’.

The complex amalgam of archaeology, ethnology, history, and philology—as well as other elements, in some cases all in the same work (e.g., Frazer 1890)—baked into these early images of TCI had a lasting impact. On the one hand, researchers who identify as classical archaeologists and Etruscologists often draw upon the ‘protohistorical’ period to supplement historical narratives (for the concept of ‘protohistory’ within Italian archaeology, see section 2.1). This perspective was articulated most clearly by the historian Arnaldo Momigliano in a famous assessment of the value of studying ‘early Rome’: “Where there is a literary tradition, it is a safer guide to [the past]. But of course archaeology can act as an excellent control [...] As early Rome is the ideal place to combine archaeological exploration and source criticism, [its study] remains an ideal school of historical method” (1963:108). The influence of this framework is pervasive even in recent work, and occasionally it manifests itself in assessments that might as well have been written in the 19th century: “such a centre [Pithekoussai, supposedly the first ‘Greek colony’ in Italy] would be open to business with the people of central Italy, who coming to contact [...] with the knowledge and culture of the Greek world, achieved a cultural leap otherwise unparalleled in the history of ancient Italy” (Gialanella 2003:178).

Anthropological reconstructions of a ‘primitive’ TCI endured in more insidious ways. As pointed out by a central figure in Italian prehistoric archaeology, Renato Peroni, they especially conditioned research on southern TCI. In combination with common tropes encountered in the literary sources, for instance, peculiar aspects of ‘Latial’ cremations conjured “alternating images of [southern TCI as] autochthonous, primitive, in a sense timeless, and isolated, closed, poor, and backward”, and in time “the problem of the ‘relationship’ between Latial cremation cemeteries and neighboring contexts, which are also and just as erroneously viewed as monolithic [...] led to an impasse, which became progressively reified” (Peroni 1997:13, my translation; the passage

goes on to extend these observations to evidence from habitation contexts).¹ The impasse to which Peroni refers boils down to the pervasive tendency to characterize ‘Latium’ as a developmental anomaly of sorts throughout much of the period under consideration. Processes south of the Tiber are routinely described as lagging behind or mimicking developments attested in the north on a reduced scale. This trend is evident in works from all disciplinary perspectives concerned with TCI, including some of Peroni’s own contributions (e.g., Bartoloni 1989:115; Bietti Sestieri 1992b:73; Peroni 1996:496; Pacciarelli 2001:179; di Gennaro and Guidi 2009b:430).

The concept of lagged development is problematic. In particular, the long record of interaction across TCI raises the question of what mechanisms led to the emergence of this supposed ‘developmental barrier’ along the Tiber and even whether it is at all appropriate to view the two regions as distinct systems. As noted by Peroni, reconstructions that emphasize differences between north and south may be influenced by later historical sources, which often present friction between individual Latin and Etruscan communities as indicative of more general and fundamental oppositions (cf. Cornell 1995:151-172). Just as important, at least in my view, is a tendency to ascribe intrinsic relational significance to forms of interaction connected to metal resources, of which ‘Etruria’ was a major source (for the general propensity to overemphasize the importance of metal production and exchange within Mediterranean archaeology, see Manning and Hulin 2005).

These interpretive trends are relevant beyond the confines of Italian archaeology, as TCI may represent an especially good case study to examine dynamics of experimentation involved in the emergence of large social collectives. Despite historical disagreement, most researchers now envision TCI as a context of radical social transformations (e.g., Pacciarelli 2001; Guidi 2006; Motta and Terrenato 2006; Bietti Sestieri 2010; Fulminante and Stoddart 2010). The BF-PF as whole is characterized first and foremost by widespread changes in funerary ritual (Bietti Sestieri

¹ “Questi caratteri, assieme a certi luoghi comuni ricorrenti nelle fonti letterarie antiche, hanno senza dubbio influito sugli studi—si veda il ripetuto accostamento, carico di significato, tra *Lazio e primitivo*, che troviamo da Pinza fino a Pallottino—favorendo l’oscillare tra l’immagine di una realtà originaria, primigenia, in un certo senso fuori dal tempo, e quella di un mondo isolato, chiuso, povero, arretrato, e non di rado le due immagini si sono venute a sovrapporre, e quindi a confondere tra loro. Non è perciò da stupire se il problema del ‘rapporto’ tra necropoli laziali ad incinerazione ed altre realtà circostanti, viste non meno erroneamente come altrettanto monolitiche (‘Villanoviano’ etrusco e campano, ‘Protovillanoviano’ di Tolfa e Allumiere, ‘cultura’ meridionale delle tombe a fossa) ha finito per farsi aporia, poi progressivamente ossificata”

2011; Iaia and Pacciarelli 2012). In the BF 1-2, groups throughout TCI adopted a standardized form of cremation burial. By the BF 3, however, many southern burial grounds exhibit distinctive elaborations of this ritual, giving rise to the designation ‘Latial culture’. With regard to demographic representation, formal funerary treatment seems to have been restricted to a very limited portion of society. No true cemeteries have come to light, with few exceptions (e.g., Poggio della Pozza in northern TCI, which probably included over 100 individuals; D’Ercole 1995). Instead, clusters made up of just a few depositions represent the only archaeologically documented expressions of funerary behavior.

With the onset of the PF 1, in contrast, settlements across TCI become associated with cemeteries made up of hundreds of burials. Cremation remains the most common disposal mode by far in the north, though depositions appear more standardized (‘Villanovan culture’). In the south, inhumation is more widely attested already in this phase. Finally, in the PF 2, inhumation dominates the record in both regions and the codified representations of social roles characteristic of preceding phases give way to a more diverse range of assemblages, usually interpreted as a shift toward individual ostentation of wealth and status (Bietti Sestieri 1992a, 1992b; Bartoloni 2003a; Riva 2010).

The evidence for settlement distribution points to a similarly dramatic series of changes. In the BF, parts of northern TCI saw a gradual shift from hilltop habitation to a relatively regular network of villages at lower altitude, though still with an eye to defensible morphologies. In terms of surface area, few sites from this period exceed five hectares. Then, between the end of the BF and the early PF 1, population seems to have converged on a limited number of extensive but again easily defensible features—in most cases, volcanic plateaus with surfaces above 100 hectares, which at first were occupied discontinuously (e.g., di Gennaro 1986; Pacciarelli 2001).

Settlement data from southern TCI are less reliable (e.g., Guidi 2000a). Hilltop occupation is attested with few breaks into the PF. According to most reconstructions, a process of settlement nucleation occurred slightly later and more gradually than in the north. The emerging centers also tend to be characterized as smaller, with few exceptions—first among them Rome, with estimates of total inhabited surface area approaching or exceeding 100 hectares already in the PF

1 (e.g., Fulminante 2014).

Although the state of the evidence has not changed substantially since the 1990s, dissatisfaction with the notion of systemic differences between north and south is on the rise. Recent contributions have noted specifically that the BF-PF transition is ripe for reconsideration on the strength of more dynamic approaches: “the current urbanization model [...], which contrasts southern Etruria (precocious, radical, and large-scale process) to *Latium vetus* (later, more gradual, smaller-scale process), even if generally viable, should be softened and expressed with more nuance. New, more dynamic perspectives are desirable [...]” (Fulminante and Stoddart 2010:15, my translation).² This chapter supplied the general context for what I hope will amount to such a perspective.

² “Senza alcuna pretesa di offrire una rassegna comprensiva ed esaustiva, gli esempi sopra citati sembrano suggerire, che il modello corrente della formazione urbana in Italia centrale, che contrappone l’Etruria meridionale (processo precoce, rivoluzionario e su larga scala) al *Latium vetus* (processo recenziore, graduale e su scala minore), sia pure generalmente valido, vada attenuato e sfumato. Nuove, più dinamiche, prospettive sono auspicabili, che lascino spazio alla variabilità e specificità locale, nel quadro più ampio di tendenze regionali (Etruria e *Latium vetus*), supra-regionali (Italia centrale) e globali (bacino Mediterraneo)”

TABLE 1.2 *Core terminology*

community

Locus of habitual face-to-face interaction regardless of apparent scale (cf. ‘social collective or aggregate’; for a discussion of archaeological usage, see Hegmon 2002; more broadly, Christiansen and Levinson 2003).

In network terms, ‘community’ denotes a dense subnetwork (i.e., a group of nodes that stands out from the background of the network according to some measure of connectivity; cf. Newman 2011:26). In order to avoid confusion, when referencing this meaning I use ‘topological community’. Unlike the related problem of graph partitioning, the detection of topological communities does not proceed from assumptions concerning the number or size of groups (Newman 2010:356). As a result, it can be a computationally intensive affair. Researchers interested in complex networks have been most active in developing and refining detection algorithms (see Fortunato 2010 for a review).

It is not always straightforward to compare topological communities to actual social entities. Still, the significance of topological communities beyond their structural properties can be evaluated by considering their composition in terms of real-world attributes of nodes that are not reflected in the information directly encoded in edges. In some cases, this procedure may lead to recognizing a grouping of nodes what may be considered a community in the social sense. Alternatively, it may reveal non-obvious relational forms.

degree

Number of edges incident to a node. In the case of directed networks, each node is characterized by an ‘in-degree’ and ‘out-degree’ (cf. ‘edge/link’). Many measures of network structure ultimately rely on the identification of patterns in degree distribution.

development

Diachronic trends associated with both the structure of reconstructed networks and the relational patterns abstracted from them (cf. ‘relational plane’, ‘structure/dynamics’).

edge

Connection within a network, most commonly between two nodes (though other types of edges may be reconstructed). Depending on whether or not it is appropriate to abstract the transactions encoded in a given dataset as reciprocal, edges may be ‘directed’ or ‘undirected’. Additionally, edges may be assigned weights reflecting their relative strength.

network

Collection of nodes and edges produced as a topological map of relational phenomena. As discussed in section 1.2, network representations can seem especially intuitive and appropriate in the case of social phenomena. Accordingly, it is important to note that networks are no less subjective than any other type of map (cf. Tyner 1974).

node or vertex

One of the items that may be linked by edges within a network. Nodes may encode several attributes, and basing them on data of appropriate type and scale is essential for generating a useful network representation. Changes in node states may have a significant impact on network structure and may in turn be affected by topological developments (cf. ‘structure/dynamics’).

relational plane

Subset of relational space determined by one or multiple interdependent transactional form(s). Similar to spheres of exchange (Bohannon and Dalton 1962), though without the requirement that they be mutually exclusive (i.e., allowing for overlaps among the transactional forms that define them; cf. Wolfe 2011:8). More appropriate parallels may be the positional approach within sociology and ‘Blau space’ (Blau 1977, 1980, 1994; for the definition of Blau space, McPherson and Ranger-Moore 1991 and McPherson 2004; on the extension of Blau space to social entities beyond the individual, Neal 2013). With regard to complex networks, seminal

contributions have explored the notion of hierarchies of group membership that determine distances among individuals across multiple dimensions of ‘identity’ (e.g., Watts, Dodds, and Newman 2002; cf. Sayama et al. 2013 for a computational model predicated on a similar conceptualization of relational distances in multi-dimensional space). The use of ‘identity’ in this sense may lead to confusion, but the point is that individuals engage in many types of transactions on a daily basis, so that relational distances between them may be variously measured.

In some cases, plotting distances based on what might be considered a priori as different types of interaction may yield similar patterns, suggesting that the underlying transactional forms make up a coherent relational plane. In practice, therefore, approximating a relational plane may require drawing from several lines of evidence and fine-tuning the initial definition iteratively in light of the structural plausibility of reconstructed networks.

social collective or aggregate

Discontinuity in the mean distribution of individuals across time and space (cf. the distributional understanding of ‘sites’ developed in Ebert 1992). This abstraction reflects the idea that communities that might be variously categorized according to one or another formal scheme are best understood in terms of dynamics both of and on networks (cf. ‘structure/dynamics’). Within anthropology, this view has been expressed clearly by James Watson, who analyzed New Guinea social groups as subsets of ‘organized flow’ in order to demonstrate that assessments of many of their organizational features as ‘non-complex’ resulted from overemphasizing formal structure (e.g., 1970).

structure/dynamics

I use ‘structure’ interchangeably with ‘topology’ to refer to the patterns of connectivity characteristic of a network and related properties. In the case of most complex networks, structural properties can change over time (‘dynamics of networks’) as a result of changes in node states (‘dynamics on networks’), and in turn structural developments can impact state changes. The interplay between dynamics of and on ‘adaptive’ or ‘coevolutionary’ networks, which is of obvious interest for archaeology, has only recently become an explicit focus of research (e.g., Gross and Blasius 2008; Gross and Sayama 2009; Blonder et al. 2012; Sayama et al. 2013).

Epidemiological networks are frequently used to illustrate this issue. For example, a change in state from ‘susceptible’ to ‘infected’ is likely to alter a node’s connectivity. Depending on the specifics of the disease, the impact of state changes on topology may be more or less immediate, and in turn patterns of connectivity may affect the rate and other aspects of state changes. The degree of time-scale separation characteristic of this feedback is closely implicated in system-level qualitative transitions by way of its effect on factors such as the extent to which topology encodes information concerning node states and nodes can access topological information (see especially Bornholdt and Rohlf 2000; Ito and Kaneko 2002; papers collected in Gross and Sayama 2009).

CHAPTER 2: FROM THEORY TO IMPLEMENTATION

In the previous chapter I set the theoretical context for the approach taken in this dissertation and introduced the research area. In this chapter I link theory to practice. Section 1 lays the groundwork for identifying a target relational plane through which to explore the underpinnings of TCI developmental trajectories. In my view, research on this context has relied too heavily on the notion of spatially circumscribed political and economic processes. Accordingly, drawing from an analogy to the different levels of linguistic variability characteristic of speech communities, I define a vernacular relational ‘register’ for the target plane in partial opposition to ‘dialects’ constrained by economic and political factors. In section 2, I argue that certain elements of archaeological datasets on mortuary practices may be well suited to tracing the development of vernacular relations. Accordingly, I set as my target mortuary vernaculars and discuss pertinent features of the TCI record.

Moving to the analytical process, section 3 illustrates how network representations of mortuary vernaculars may be generated from burial-object affiliations and their structural plausibility evaluated by examining groups of highly interconnected nodes. As mentioned in table 1.2, it is important not to assume the real-world relevance of topological patterns. In section 4, therefore, I outline a computerized procedure for assessing the statistical association between clusters of nodes and variables not directly encoded in the networks. Using sample datasets from TCI, I argue that the structure of reconstructed networks does in fact capture patterns in the distribution of independent burial attributes, so that after accounting for the impact of non-spatial variables it may be reasonable to interpret summary measures extracted from the networks as indices of relational distances at various scales of spatial aggregation. Given the need to test this suggestion more directly, I introduce the possibility of comparing measures of vernacular variability to isotopic reconstructions of mobility patterns based on targeted samples from the late PF, when even according to conventional models all parts of TCI encompassed large social collectives.

1. REGISTER OF TARGET RELATIONAL PLANE

I am interested in evaluating conventional reconstructions of social trajectories within late-prehistoric TCI—specifically, the notion that fundamentally different collectives developed within southern ‘Etruria’ and ‘Latium’, which have long been viewed as culturally and/or ethnically distinct. There is no doubt that the BF-PF transition encompassed dramatic transformations across this part of Italy, and it may well be accurate to view these as manifestations of a coherent developmental phenomenon. The question is whether reconstructions of these changes capture a representative range of the underlying dynamics. By virtue of its potential to shed light on alternative axes of complexity, investigating a previously neglected relational plane would contribute to answering it. In order to lay the groundwork for isolating an alternative plane, I begin by expanding the discussion of trends in the study of TCI and conventionally invoked evidence provided in section 1.3.

Despite the diverse interest groups involved, research on TCI has long been anchored to a uniform evidentiary base. Comparative assessments of developmental trajectories rely first and foremost on studies of locational preferences in relation to easily defensible landscape features, metal deposits, and communication routes. With regard to more fine-grained processes, such as may be glimpsed through diachronic and synchronic comparison of intrasite organization and mortuary practices, privileged factors include asymmetries in the production and consumption of metal goods and the distribution of imported material culture, the establishment of sacred precincts, changing attitudes toward the disposal and symbolic representation of weapons, and preference for inhumation versus cremation and the connected issue of miniaturization of grave goods.

Preoccupation with these lines of evidence developed over the course of the last century as researchers with diverse backgrounds confronted an already rich tradition of archaeological, historical, and linguistic work. Insofar as it fostered more systematic concern with economic and political reconstruction, a principal catalyst was the establishment of historical materialism as a common ground for classical archaeologists, ‘protohistorians’, and other interested parties in the aftermath of the Second World War (cf. Danckers 2014). Of course, Marxism variously declined came to shape archaeological research on many contexts around the same time, but at least in the

case of TCI its establishment did not amount to a paradigmatic shift. Idealist programs geared toward mapping cultural sequences were simply refactored, which is to say that the advent of historical materialism consolidated attention on classes of evidence such as those outlined above but left unscathed a propensity to think of past processes as corralled within ‘actual’ cultural boundaries (see Terrenato 2005 for a more detailed consideration of the relationship between idealist and materialist perspectives within Italian archaeology). Despite warnings against this procedure, moreover, the distinction in the literary tradition between ‘Etruscans’, ‘Latins’, and smaller contingents was taken to imply that such boundaries could be confirmed rather than discovered for the end of the PF and then projected back modularly to historically hazier phases (critical assessment in Peroni 1996:346-347).

This thread of continuity had positive ramifications. Perhaps most important, the common language it supported helped sustain large-scale efforts to systematize existing data—a daunting but necessary task given the substantial volume of documentation produced through centuries of antiquarian work—and trace the circulation of select categories of material culture in detail (e.g., Bietti Sestieri 1981, 1985; Peroni 1994, 1996 and many of the volumes in a seminal series he launched, “Grandi contesti e problemi della protostoria italiana”; recently, papers on resource exploitation and exchange collected in Bietti Sestieri 2006; also telling are the many contributions pertaining to late-prehistoric TCI in the “Prähistorische Bronzefunde”). On the other hand, it stunted the development of explicit theoretical frameworks. Even as efforts to clarify the foundations of research and relate them to broader archaeological interests intensified (e.g., Peroni 1994; Bietti 1996; Bietti Sestieri 1996; Guidi 2000b), experimentation with novel theoretical and methodological frameworks remained tethered to the concept of culturally bounded economic and political processes.

This phenomenon is manifest in the pervasive notion of ‘protourban centers/complexes’, which emerged as a shorthand for the historically contingent activation of spatial conjunctions of resources and landscape features with a high potential for ‘Complexity’: “what were once termed the material conditions of production made possible the development of state societies, an expression of which is territorial organization anchored to protourban centers. In areas where the range of available resources was sufficient to support local communities, demographic growth limited, and major communication routes distant [...] this did not take place” (di Gennaro and

Guidi 2009b:442-443, my translation; cf. Bietti Sestieri 2005; Gnesotto 2006; Bietti Sestieri and De Santis 2007; Attema, Burgers, and van Leusen 2010; Iaia and Mandolesi 2010; note also that Renfrew included northern TCI as a case study to demonstrate his concept of Early State Modules; Renfrew 1975; cf. Redhouse and Stoddart 2011).³ By shifting focus to the trajectories of individual settlements and their catchments, this notion might have contributed to challenging the old culture historical map. Divorced from an explicit theoretical framework, for the most part it led to the deployment of Thiessen polygons to fill in its contours and systematic mortuary analysis to add color, with results easily portable to idealist historical reconstruction (e.g., Carandini 1997).

For the purposes of this work, then, it seems productive to target relational patterns and boundaries within a plane not inherently tied to differential access to scarce resources and processes of economic and political stratification. In what ways, if any, might such relational trends differ from those suggested by the established cultural map? What would such differences or their absence imply regarding current assessments of developmental trajectories?

It is neither possible nor desirable to distinguish non-overlapping cultural, economic, or political planes (cf. table 1.2). Language offers a useful analogy to underscore this point. Within a hypothetical closed social system, all transactions may be seen as expressions of a common ‘linguistic’ base characterized by ‘dialect’ variation at different levels of social accessibility, prestige, and so on. Within a realistic context of interaction, however, dialects often vary within and between these levels as gradients, so that even in cases of imposed standardization it does not make much sense to conceptualize fixed linguistic boundaries or assume associations between predefined levels of variability and broader phenomena. Synchronic and diachronic linguistic variability is best understood as structured heterogeneity arising from a multifaceted relational ecology (e.g., Weinrich, Labov, and Herzog 1968; Foley 1988; Mannheim 1991).

Based on select prestige dialects, reconstructions of social development within TCI tend to view

³ “In realtà sono quelle che un tempo si definivano condizioni materiali della produzione a rendere possibile l’affermazione di società di tipo statale, di cui è espressione l’organizzazione territoriale fondata sui centri protourbani. Laddove lo spettro delle risorse disponibili era sufficiente alle comunità locali, l’incremento demografico assai contenuto, la posizione geografica lontana dai grandi assi di collegamento lungo cui avvenivano gli scambi all’interno dell’area mediotirrenica e con le altre aree territoriali, tutto questo non avvenne, se non come forma estrema di resistenza all’espansione dello Stato romano più che come esito di un processo di crescita autonoma”

southern ‘Etruria’ and ‘Latium’ as well bounded systems (even as the notion of an actual linguistic boundary along the Tiber begins to be challenged methodically; e.g., Marchesini 2008). Just as in the study of actual languages, this may feed misguided notions of standardization and absolute systemic ‘Complexity’. In contrast, I aim to reconstruct an inclusive, vernacular plane, by which I mean one shaped more by the basic range of interaction of individuals (cf. Labov 1972).

Admittedly, the concept of vernaculars is to a certain extent inextricable from the social context of expression, leading to its juxtaposition with notions of prestige and standardization (see Macauley 1988 for a critical assessment, including other uses of the term within sociolinguistics). Still, I find the idea of variability within a plane characterized at least in theory by universal accessibility useful—everyone has a vernacular base for communication, though they may choose not to emphasize it depending on the content and intended audience of messages. If the social context of expression is fixed, the concept of vernaculars may thus be recast to describe those aspects of variability characterized by the greatest potential for free expression. As a corollary, given a dataset encoding aggregate outcomes of interaction expressed in various media, vernaculars should be reflected most clearly by elements not intrinsically tied to the social context (i.e., which on their own do not carry a substantial amount of context-specific semantic information).

These are assumptions, of course, and I will reevaluate them throughout the rest of the dissertation in terms of the structural plausibility of reconstructed networks as well as more direct lines of evidence (see below, section 2.4). Based on my broad-brush characterization of research trends within TCI, however, it seems useful to aim for vernaculars thus defined. Having identified a register for the target relational plane, I now turn to fixing its social context.

2. SOCIAL CONTEXT OF TARGET RELATIONAL PLANE

In order to select a social context that is practically as well as theoretically appropriate for approximating vernacular relations, it is convenient to frame the discussion in network terms from the onset. Systems of social entities configured within potentially overlapping relational planes may be represented through multipartite/multi-mode networks. Within such networks, edges connect different types of nodes—usually discrete agents to the various groups to which

they belong, if known, and/or attributes they share. For example, researchers could be connected to categories of institutional membership, funding sources, and individual research projects and papers to which they contributed, among other possibilities. Incorporating many types of variability into a single representation can help bring out intersecting patterns of affiliation, which makes multi-mode networks ideal conceptual bases to define relational planes iteratively.

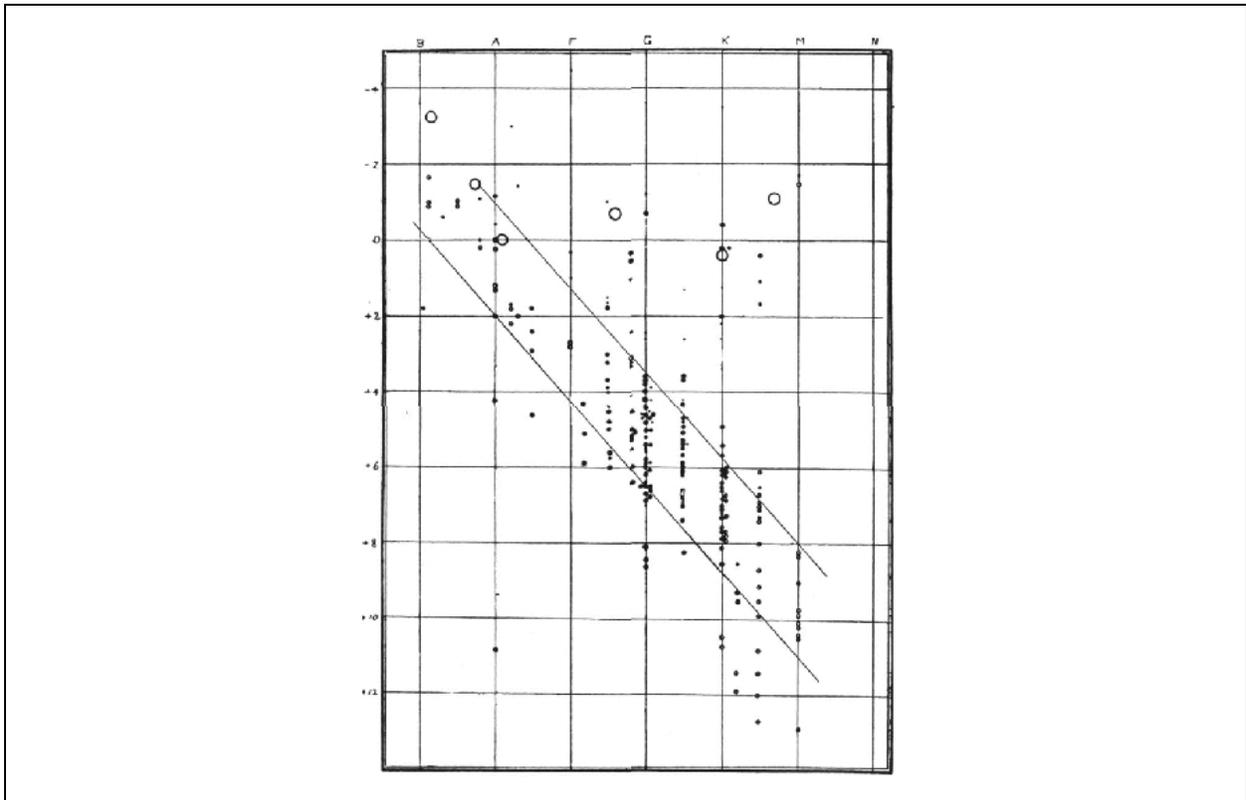
In practice, working directly with this type of network can be burdensome. Many of the tools available to study patterns of connectivity were designed for networks consisting of only one type of node, and it is far from trivial to adapt even basic measures for the analysis of multi-mode representations. Consequently, it is often preferable to extract nodes of a single type and connect them in such a way as to capture their affiliation with nodes of other types (i.e., to project pertinent elements of a multi-mode network onto one mode; for problems associated with this procedure, see Latapy, Magnien, and Del Vecchio 2008; Padrón, Nogales, and Traveset 2011; Opsahl 2013). This will inevitably involve some information loss, but the likelihood of capturing important patterns can be maximized by setting edges to reflect the total number of mutual affiliations or some other quantification of the attributes shared by pairs of nodes (e.g., Newman 2001b, 2010:123 ff.). The projection process thus boils down to selecting nodes that can be related to meaningful social entities and appropriately weighting affiliations relevant to the target relational register. I begin by addressing the issue of node selection.

It is tempting to set as nodes settlements and other spatially discrete loci of recurring face-to-face interaction, or in practice to ground networks at the level of ‘sites’ beyond some minimum threshold of background noise (at least in the general sense of ‘site’; see Dunnell 1992 for a critical review). This straightforward solution is not ideal. In section 1.2, I argued that failing to include archaeology fully within developing perspectives on complex networks would be as limiting as pursuing an Earth-bound astrophysics. In a similar vein, proceeding from site-level networks would be analogous to foregoing the full potential of astrophysics in favor of purely optical observation, or in other words approaching cosmic phenomena exclusively through the relative position and apparent magnitude of visible light sources. Granted, quite a lot can be achieved in this way, including distinguishing between stars and planets, deducing general patterns of motion, and discovering that some clusters of objects actually correspond to coherent systems while others exist only relative to the position of the observer. Site-level networks can

be just as informative, and in fact their analysis has yielded considerable results for southern TCI (e.g., Fulminante 2012).

Nevertheless, more may be learned by starting at a level closer to the stuff that makes up the discontinuities, not as a form of atomism but in recognition that appropriate scales and wavelengths of observation should not be predetermined. To reprise the astronomic analogy, observing relative positions can lead all the way to deriving absolute from apparent magnitudes for a significant number of stars, but a useful classificatory basis for explanation emerges only in conjunction with the internal dynamics suggested by their spectra (fig. 2.1; cf. Dick 2013:294 ff. for a recent discussion of the epistemological implications of the development of spectroscopy). Even more alluring, it is only on the strength of observation at different wavelengths that previously unimaginable, highly emissive objects may be defined as a new class of ‘active’ galaxies, and then only through further comparison of their spectra that a unified model may be proposed to explain them as manifestations of the same phenomenon (e.g., Antonucci 1993).

FIGURE 2.1 *Early representation of the relationship between spectral classes and absolute magnitudes of stars (horizontal and vertical axes, respectively; Russell 1914:252, fig. 1). Modified versions of such plots, known as Hertzsprung-Russell diagrams, are central to the modern understanding of stellar dynamics and evolution. Adding the spectral axis was similarly crucial to classifying and explaining other cosmic phenomena.*



In recent years, research on complex networks has begun tackling feedbacks between dynamics of and on systems of interaction (cf. table 1.2; for example, this potential is being developed intensively through work on trend and event prediction based on large social media datasets; e.g., Adar et al. 2007; Mishra, Romero, and Tsaparas 2013; Cheng et al. 2014; Kuhen, Martens, and Romero 2014; Kong et al. 2015). In my view, this raises the prospect of a social spectroscopy. Formal similarities among individual sites or groups of sites may conceal heterogeneous dynamics at lower scales or vice versa, and in terms of developmental trajectories lower-level dynamics may help account for sudden reconfigurations following a phase of site-level topological stability, to cite one scenario. Although such dynamics may be identified through various techniques, the problem extends beyond detection to assessing their reverberations across scales and relational planes in a conceptually consistent manner, which is where tools developed for the analysis of complex networks come into play.

These considerations argue for setting as nodes the most temporally and spatially constrained aspects of a record of interaction that may be treated as discrete units. The aim, however, is not to get at individual transactions. Just as in the case of stellar spectra, averages of ranges of basic interactions should suffice. The remainder of this section identifies burials as ideal candidates to serve as nodes.

Burials may represent only a small component of social practices associated with death and the disposal of bodies, but in most archaeological contexts they constitute their clearest material correlates. Although multi-stage interment practices and other factors can complicate the picture, they often take the form of sealed depositions of variously treated human remains in association with material culture. At least compared to many other types of archaeological features, therefore, burials come close to representing single, brief events.

Nevertheless, it would be incorrect on this basis to treat burials as proxies for individual social actors. To begin with, single graves frequently contain the remains of multiple individuals. Even though this does not seem to have been the norm within TCI, many examples have been documented (at Grotta Gramiccia, for instance, and recently at Villa Bruschi Falgari, PF burial grounds associated respectively with the sites of Veio and Tarquinia; Berardinetti and Drago 1997:40; Trucco 2007:189). More fundamental, burial attributes are configured by survivors in

accordance with a host of more or less conscious logistical, emotional, and ideological considerations. As a result, they are unlikely to add up to an objective or comprehensive codification of the social profiles of the deceased (e.g., Brown 1995:18-21). Unless the goal is to reconstruct individual biographies or arrive at an idealized representation of social structure, however, this is not a problem. In fact, the convergence of variability from a broad range of sources in formally tractable units presents distinct analytical advantages (cf. O'Shea 1996:8 ff.).

Rather than idiosyncratic takes on a unique occurrence, burials amount to expressions of an ongoing dialogue at the level of family units and/or other corporate groups responsible for the funerary process about a ubiquitous social fact. At least for the present purposes, this means that burials amount to something more useful than snapshots of individuals. They offer a glimpse, however partial, onto the intersection of collective structures and individuals confronting a major recurring event—that is, onto the sorts of abovementioned feedbacks between dynamics of and on systems of interaction.

The logic behind setting burials as nodes thus rests on their potential to inform on a base relational level somewhere between individuals and collectives, not the mistaken idea that they reflect discrete actors. Just as important, their suitability for extricating vernacular variability does not hinge on the assumption that mortuary practices are somehow divorced from economic and political processes, as might be argued based on a unidimensional assessment of their formal variability: “it appears that a feature which is pretty likely to characterize mortuary practices is their dissociation from certain large blocks of cultural activity, especially those having to do with material and economic life, its subsistence and mechanical aspects” (Kroeber 1927:314; see Bell 1992 for the historical tendency to excise ‘rituals’ and ‘traditions’ from their social contexts). Although frequently associated with recent appraisals of mortuary archaeology (e.g., Parker Pearson 1999), emphasis on the embeddedness of funerary behavior within multiple levels of social practice was at the core of many early contributions (see Binford 1971 for an explicit discussion of the above passage from Kroeber; cf. Saxe 1970; Brown 1971; Tainter 1975; Goldstein 1976).

I proceed from the same appreciation of the multivalence of mortuary data, but my aims and methods are different. For the most part, those seminal studies were concerned directly with the

social personae represented in burials. Insofar as configurations of burial attributes may be conceptualized as grammatical statements, in other words, their goal was to ‘decode’ them systematically. In contrast, I aim to define vernacular communities by mapping spatial and temporal trends in the way similar information was conveyed. I am thus only concerned with semantics to the extent that they are required to ‘correct’ for the information encoded within the most basic elements of mortuary statements, if any, on the way to isolating unconstrained lexical and syntactical patterns.

This approach may be dismissed superficially as a version of the ‘historical-distributional’ perspectives critiqued in early contributions (e.g., Binford 1971:9 ff.). I hope it is clear by now that the end goal is precisely the opposite of tracing genealogical relationships among monolithic culture areas, but I do think that at some level distributions of formal alternatives in mortuary statements are bound to be associated with patterns of relational proximity within a coherent plane. Aside from theoretical differences, in practice the key departure from conventional distributional approaches is the potential to validate reconstructed networks well before the stage of interpretation. As demonstrated in the following section, this can be accomplished by comparing topologies inferred from the distribution of formal variants to expected configurations for complex systems of interaction. Before proceeding, however, I identify aspects of the TCI funerary record that may be relevant for mapping vernacular trends.

At the beginning of this section I discussed the utility of reconstructing networks based on patterns of ‘affiliation’. Within archaeology, the concept of ‘affinity’ has been used in a similar way to underscore the importance of examining not just direct parallels among artifacts but similarities in their broader associations (Taylor 1948:94 ff.), and by extension to point out that variables such as the overall pervasiveness and spatial distribution of burial attributes may impact the likelihood that they will be implicated in relevant patterns for a given research objective (O’Shea 1984:41-44). Given the goal of parsing vernacular variability, pertinent affinities may be identified among attributes widely distributed across time and space and whose manifestation is unlikely to reflect availability or other barriers to procurement or disposal.

Although no class of attributes occurs universally within the rich and varied TCI mortuary record, a frequent feature is the inclusion of material culture not functionally associated with the

structure of burials (e.g., pots other than containers for the remains or larger protective enclosures). Cremations and inhumations of both sexes and across age categories and subsections of burial grounds tend to feature complex combinations of pottery, metal goods, and other types of objects (fig. 2.2).

FIGURE 2.2 *Sample burial assemblages from TCI (not to scale; left: BF cremation, Puntale al Norcino 13, northern TCI; Iaia and Pacciarelli 2012:342, fig. 1, originally from Brusadin Laplace 1964; center: BF cremation, Quadrato 1, southern TCI; De Santis 2008:200, fig. 151; right: PF inhumation, Osteria dell'Osa 508, southern TCI; De Santis 2008:206, fig. 157; note that first two assemblages also include the cinerary urns and covers).*



Frequency alone does not imply that such inclusions formed part of structured systems of expression. Pottery vessels could have been used for libations or commensal components of the funerary ritual, metal and other ornaments could represent remains of attire, and objects of all sorts could have been included because they were idiosyncratically significant to the deceased or emblematic of their relationship with certain survivors. None of these possibilities necessarily diminishes their utility for parsing social differentiation. Even in the case of idiosyncratically meaningful objects, for instance, the distribution of variables connected with scarcity, provenance, and so on might be instructive. The primary aim of mapping vernacular variability, however, can only be pursued by identifying expressive variants within a record of structured statements. Consequently, it is reassuring that within substantial chronological and spatial subsets of TCI the composition of certain elements of burial assemblages seems to have been determined in reference to established codes, as suggested by trends such as the substitution of standard objects with miniaturized but otherwise identical versions while respecting broader patterns of association (e.g., Bietti Sestieri and De Santis 2012).

Pots and other fired clay items, in particular, constitute the most numerous and evenly attested class of material culture within TCI burials, and one whose inclusion was probably not dictated by absolute procurement or disposal barriers. While burials of subsequent periods encompass a wide range of sophisticated types suggestive of specialized workshops, during the BF and much of the PF most such objects appear to have been produced as the need arose at the household level (again, not considering urns and other containers functionally associated with the structure of the deposition). In the case of pottery, which has been studied most intensively, household production dominated down to at least the beginning of the eighth century (e.g., Nijboer 1998:50 ff.; for the specific case of pottery recovered from a funerary context, the cemetery of Osteria dell'Osa in southern TCI offers the most detailed case study; Cuomo Di Caprio 1992; for the social connotations of production in the community associated with this cemetery, see Bietti Sestieri 2008).

Granted, it is dangerous to make assumptions about the emic value of individual objects or object-level attributes. For example, despite theoretical and methodological differences, recent explorations of the sources and interpretive potential of ceramic variability agree that no single aspect of production or consumption can be linked consistently to specific units or types of interaction, population dynamics, or forms of horizontal or vertical transmission, let alone absolute value systems (e.g., Sinopoli 1999:120-121; Shennan and Wilkinson 2001:592; Gosselain 2008:176). In combination, however, widespread availability of raw materials, technological simplicity, low degree of stylistic elaboration, and overall abundance in the record suggest that most of the coarse wares and other clay objects within TCI burials may be seen as less 'costly' inclusions than the metal ornaments and implements, exotic jewelry components, and few other items found alongside them (cf. Pollock 1983:19-20).

Consequently, the presence or absence of such clay objects is unlikely to reflect social distinctions and inequalities connected with economic and political processes (cf. Brown 1981). Even in the best-studied cases, it is difficult to identify social categories marked primarily through their inclusion, and when associations do surface they tend to be very broad (e.g., biological sex and some generic age classes; summary assessments are provided in English in Bietti Sestieri 1992b:102-140; Iaia 1999:141-148; De Santis 2005). Nevertheless, emphasizing one or another aspect of this broad category of objects can result in very different

reconstructions. Practices like miniaturization, for instance, may well represent a higher level of effort compared to the inclusion of corresponding standard vessels. In order to evaluate which types of objects and object-level attributes are most suitable for identifying vernacular variability and how they should be weighted, it is necessary finally to introduce specific methodologies to generate networks and assess their structural plausibility.

3. NETWORK GENERATION AND STRUCTURAL VALIDATION

Network and other approaches to complex systems of interaction have generated evidence for regularly occurring structural properties and patterns of diachronic development (e.g., Barabási and Albert 2002; Watts 2004; Boccaletti 2006; Leskovec, Kleinberg, and Faloutsos 2007; Scheffer et al. 2009). Detecting topological communities and understanding their significance, in particular, have emerged as central concerns in the comparative study of complex networks. Topological communities may be identified using various techniques (see Fortunato 2010; Newman 2011), and their composition and overall organization can capture aspects of interaction not evident at the level of single nodes or an entire system (Yang and Leskovec 2014). Recent contributions have tackled issues including how node attributes not directly encoded in a network can be used to appraise the relational significance of topological communities and the challenge of tracing their evolution across temporal snapshots of a system (Clauset, Moore, and Newman 2008; Aynaud and Guillaume 2010; Kim and Leskovec 2011; Yang, McAuley, and Leskovec 2013; Yang and Leskovec 2014; Peel and Clauset 2015).

The composition and articulation of topological communities can also shed light on the structural plausibility of networks. Many techniques for the detection of topological communities are non-deterministic, so that different algorithms or even repeated application of the same algorithm may yield conflicting results. This apparent drawback can be exploited to isolate sets of nodes so closely affiliated that they are consistently grouped together by multiple algorithms or iterations of the same heuristic (Lancichinetti and Fortunato 2012; Chakraborty et al. 2013; Zhang and Moore 2014; Burgess, Adar, and Cafarella 2015). In this and the following chapters, the evaluation and analysis of reconstructed networks proceed from the detection of ‘stable community cores’ (table 2.1).

By running a non-deterministic community detection algorithm repeatedly and keeping track of

community membership, it is possible to produce a second graph in which the original nodes are connected according the proportion of runs in which they were grouped together, so that each edge will have a weight between zero and one. As discussed in section 3.1, I use these weights as summary measures of relational distance. Additionally, removing all edges whose weight falls below a given threshold may result in the dissolution of the new graph into two or more ‘community cores’, and repeating this process at various thresholds should yield a nested hierarchy of cores. In a wide variety of network representations of well studied interaction data as well as benchmark models with parametrically set structure, cores over substantial ranges of α have been found to correspond closely to ‘ground truths’ for group composition and organization (Seifi et al. 2013; Campigotto and Guillaume 2014).

TABLE 2.1 *Pseudo-code for the detection of stable community cores (adapted from Seifi et al. 2013:90, algorithm 1). In the analyses presented below, the classical Louvain detection method is used as the base non-deterministic algorithm A (Blondel et al. 2008; all pairs of nodes considered, order randomized at each application). Rather than supplying the number of runs as input, the base algorithm is applied until the variation of p_{ij} converges below a small threshold ε (cf. Wang and Fleury 2012:473, eq. 11).*

1. Input: a graph $G = (V, E)$, a threshold α , a number of executions N , a non-deterministic community detection algorithm A
2. Apply N times the algorithm A to G
3. Create a matrix $P_{ij}^N = [p_{ij}]_{n \times n}^N$ where p_{ij} is the proportion of times i and j belonged to the same community
4. Create a complete weighted graph $G' = (V, E', W)$ with $|V|$ nodes and p_{ij} as weights
5. Remove all edges ij where $p_{ij} < \alpha$ from G' to obtain G''_α
6. The connected components of G''_α are α -cores

Analyzing core structure at set intervals between zero and one can provide key information concerning the cohesiveness of topological communities and the overall degree of hierarchical nesting within a network. Remarkably, some trends of cohesiveness and nesting seem to hold across superficially dissimilar systems (fig. 2.3). As higher α thresholds are applied (step 5 in table 2.1), the size of cores drops relatively gradually, and because some pairs of nodes are always grouped in the same community a few multi-node cores remain even as α approaches one. Within networks known to lack topological communities, in contrast, core sizes suddenly transition to trivial values. The difference is most apparent when comparing the properties of representations of actual interaction data to those of networks with the same number of nodes but connections distributed according to random models (fig. 2.4). In contrast with the actual network representations, in the case of the random models all pairs of nodes are grouped in the

same topological community at least once, while very few, if any, are always grouped together. These patterns can serve as guidelines for evaluating the plausibility of reconstructed networks.

FIGURE 2.3 *Regularities in the organization of community cores across network representations of different systems (messages exchanged among 1,133 university email accounts, patterns of collaboration on 13,861 papers, and a one-day snapshot of Internet activity encompassing 22,963 autonomous systems; adapted from Seifi et al. 2013:91-92, figs. 2, 4; cf. Campigotto and Guillaume 2014:151, table 1). In all three cases, the average size of cores and size of the largest core decrease gradually as α is increased (top left and right, respectively). Similarly, plotting the complementary cumulative distribution function for p_{ij} shows that some pairs of nodes are always placed in the same community (bottom; cf. step 3, table 2.1).*

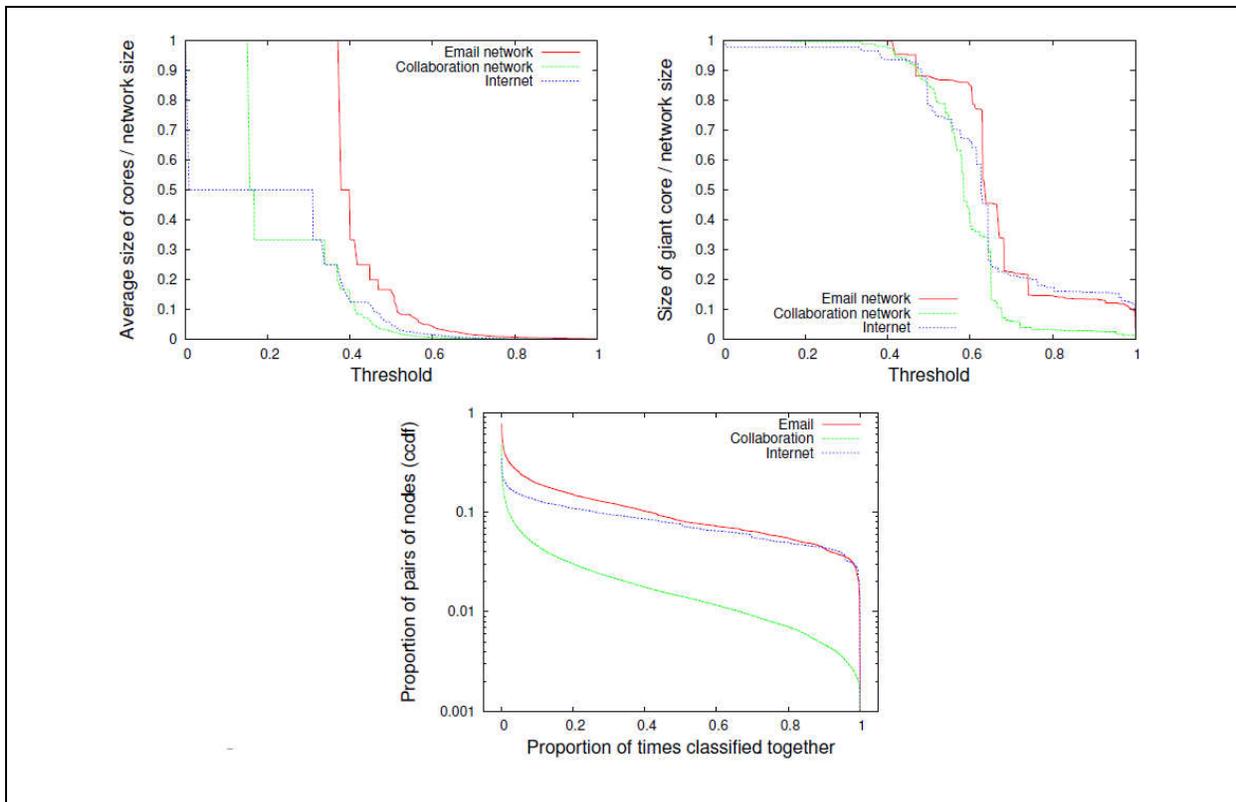
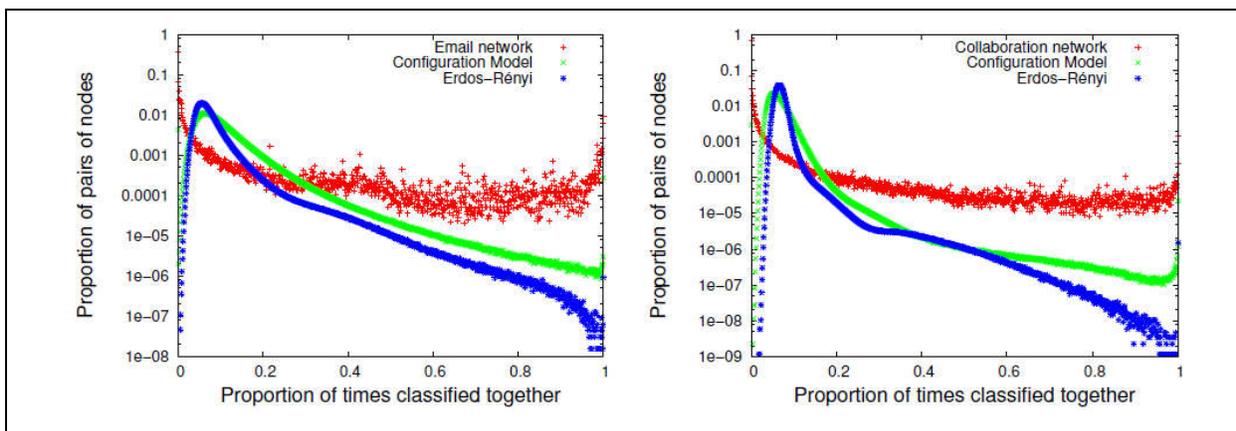


FIGURE 2.4 *Comparison of the email and academic collaboration networks to random models (adapted from Seifi et al. 2013:97, fig. 8).*



Networks that are based on incongruous temporal spans, conflate multiple relational planes, rely on irrelevant or incorrectly weighted attributes, or otherwise conceal actual interaction dynamics should display anomalous core organization. Anomalies may be minor if a representation captures at least some aspects of interaction dynamics (i.e., community core organization may not appear purely ‘random’), which can make it difficult to gauge the absolute validity of reconstruction parameters. Nevertheless, it may be reasonable to evaluate the relative appropriateness of alternative parameters by comparing the resulting patterns of community core organization and p_{ij} distributions side-by-side.

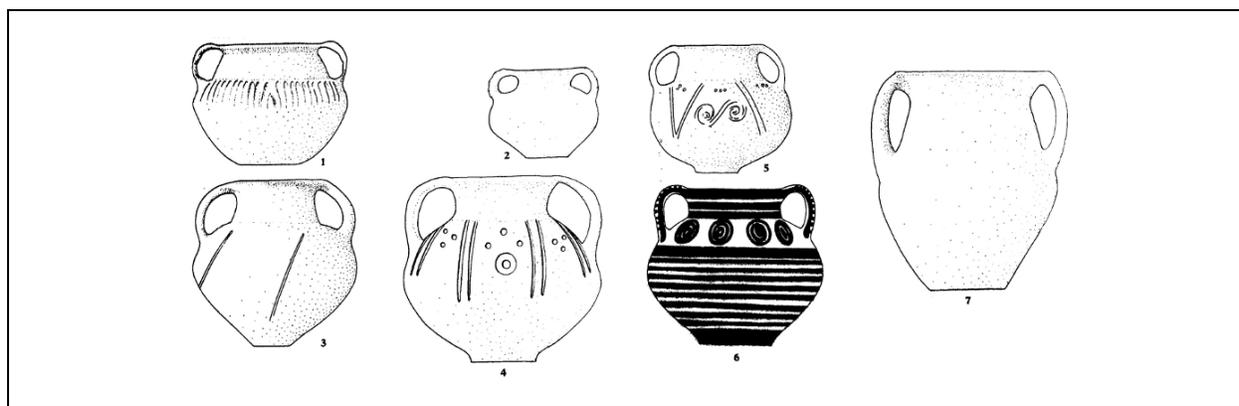
In order to illustrate the potential of this approach for evaluating burial affiliation networks, I now examine the impact of connecting nodes in different ways and varying temporal spans using control datasets from TCI. As discussed at the end of the preceding section, focusing on one or another aspect of burial assemblages and relying on alternative classificatory schemes to derive affiliation patterns from the co-occurrence of objects could substantially affect network representations. For example, if it is correct to assume that the distribution of carefully produced, context-specific objects might be susceptible to acquisition and/or disposal barriers related to status, then encoding stylistic variability in edges could mask the target signal of vernacular variability. Classifying objects according only to probable function might seem more sensible, but it could just as well result in misleading connections.

This problem may be considered using data derived from a seminal effort at chronological seriation for southern TCI (Bettelli 1997). The underlying sample is not perfect, as it understandably excludes burials that were deemed unsuitable for the specific purpose of seriation and has not been updated to reflect subsequently published data (e.g., the final report on the major cemetery of Osteria dell’Osa appeared after the work had been completed; Bettelli 1997:28). Still, the Bettelli study represents a rare attempt to compare all attested classes of material culture from multiple funerary contexts within southern TCI. Nearly all known BF 3 and PF burial grounds are at least partially represented, though the majority of the data come from PF 1 Rome and Osteria dell’Osa.

The underlying classification system defines relationships among objects hierarchically, from the level of formal categories to types, varieties of types, and unique occurrences, taking into

account attributes such as dimensions, shape, and extent and type of decoration. This raises the possibility of setting classificatory specificity as a tunable parameter for network reconstruction. At the highest level of the hierarchy, for instance, miniature and standard versions of the same shape are grouped together. Reconstructing networks at this level would obviate concerns about symbolic or other associations of miniaturization with status distinctions, but a potential downside is that edges would be established or strengthened even on the basis of very superficial similarities (fig. 2.5).

FIGURE 2.5 *Subset of the heterogeneous range of objects making up Bettelli's category 10 ('amphorae'; adapted from Bettelli 1997, table 26).*



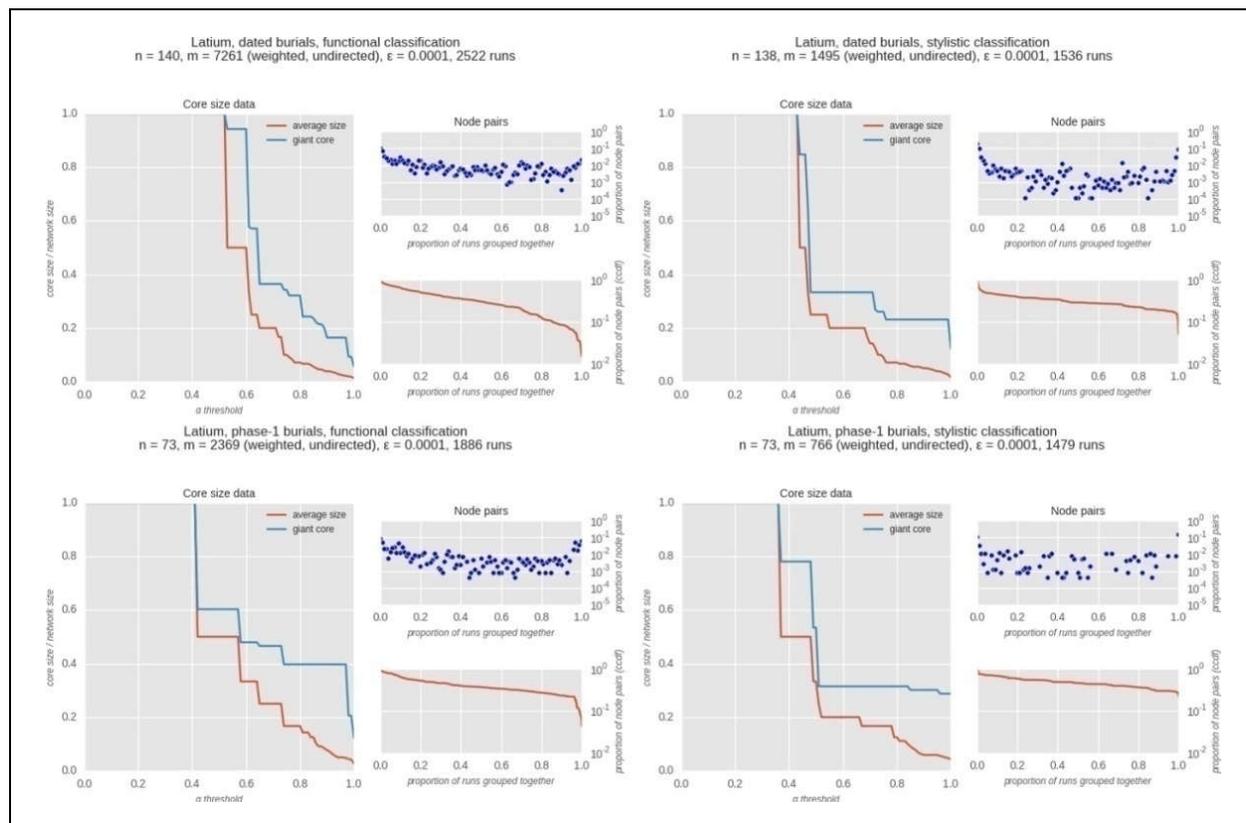
Even at a given level of classificatory resolution, edges can be variously weighted. Taking into account the overall popularity of objects, for instance, could offset the risk of reconstructing artificially extensive affiliations as a result of working at coarse classificatory resolution. Additionally, assuming that it is possible at least in theory that mortuary vernaculars could reflect interaction dynamics, then burials that share unusual elements may point to closer affinities among the groups that shaped their attributes.

A technique that adjusts edge weights for the incidence of the underlying attributes within the sample as a whole was tested on several datasets (technique described in Newman 2001b). The effect of the adjustments varied widely. Pending further work, therefore, the distribution and weight of edges within the base networks analyzed below and in the following chapters reflects directly the co-occurrence of objects. Burials that have n objects in common according to the level of classificatory specificity under consideration are connected by an edge of weight n regardless of how frequently those objects occur in the sample as a whole. In the case of burials that contain two or more instances of a given object, moreover, each instance beyond the first

carries the same potential to strengthen edges as any other object. For example, a burial containing two bowls and one jug will have the same connection with burials that contain either one bowl and one jug or just two bowls—an edge of weight two.

The Bettelli sample supported the reconstruction of networks consisting of up to 140 burials. Regardless of classificatory specificity or temporal span, all tested representations exhibit community core organization and p_{ij} distributions inconsistent with expectations derived from random models (fig. 2.6; cf. fig. 2.4). At the same time, none displays inherently convincing patterns. These networks thus point to the existence of interesting structure but seem to capture it only partially, which is not surprising given the heterogeneity of the sample.

FIGURE 2.6 *Network representations of the Bettelli sample (top: all burials, bottom: PF 1 only; left: ‘functional’ classification; right: ‘stylistic’ classification; the level of variants did not yield viable results).*



As anticipated above, while it is difficult to determine the absolute plausibility of such networks, structural comparison may prove informative. Networks founded at the level of types display less coherent community core organization than those based on the highest level of the classificatory hierarchy, which essentially encode information about the distribution of functional categories.

The former appear to be dominated by a few static sets of nodes, as indicated by the interdependence of average and giant core sizes. Similarly, although as expected some node pairs are always grouped together, type-based networks lack much of the interesting structure usually found between extremes of affinity. Several factors could account for these patterns. Generally, it may well be that the more specific the classificatory basis for edges, the higher the risk of conflating relational planes.

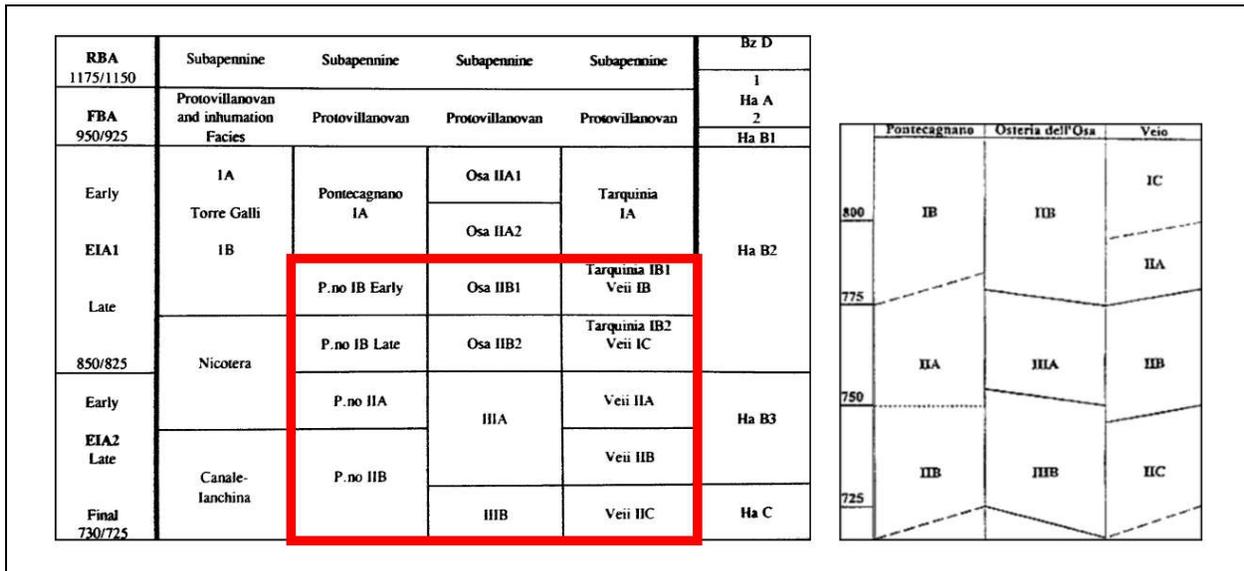
With regard to temporal resolution, the most plausible patterns emerge from representations of the entire sample, which include burials from the BF 3 to the end of the PF. This is particularly interesting in light of the fact that traditional chronologies for southern TCI conceive of a variously articulated ‘Latial culture’ extending from the BF 3 to the sixth century (first defined in Müller-Karpe 1959 and 1962; although several revisions have since been proposed, the broad outline has remained unchanged; e.g., Colonna 1974, 1976; Bettelli 1997; Pacciarelli 2001). It might be tempting to see in the more convincing patterns exhibited by the ‘functional’ network founded on all burials a coherent vernacular base for the early phases of the proposed ‘Latial culture’. Quite aside from the superficiality and limited quantitative basis of the analysis, any such reading would be liable to circularity, as the Bettelli sample was compiled for the explicit purpose of refining the established Latial chronology. Nevertheless, the prospect of using community core organization to assess chronological coherence is tantalizing.

Unifying relative chronologies from different parts of TCI has proven challenging. Attempts to overcome this major hurdle for comparative work have invoked dendrochronological sequences from northern Italy and beyond, historically derived chronological ranges for objects widely distributed throughout the Mediterranean, and an expanding database of archaeometric dates from TCI itself (fig. 2.7; e.g., Nijboer et al. 2000; Pacciarelli 2001; Bartoloni and Delpino 2005; Bietti Sestieri and De Santis 2008; van der Plicht, Bruins, and Nijboer 2009; Fantalkin, Finkelstein, and Piasezky 2011). None of the resulting proposals has been widely embraced—many researchers nominally accept that absolute dates for the BF and early PF should be raised by 25 years or more, but in practice most remain noncommittal.

The lack of a widely accepted chronological framework spanning TCI, let alone one not founded on the seriation of funerary data, argues against subdividing the available dataset for network

reconstruction too narrowly. Below and in the following chapters I rely on the periodization outlined in table 1.1. With regard to correspondences among local sequences, I follow the framework highlighted in red in figure 2.7 (for the suitability of this framework, see Nijboer 2010:14, n. 58). For example, Tarquinia IA-IB2, Veio IB-IC, and Osa IIA1-IIB2 are all subsumed as PF 1.

FIGURE 2.7 *Chronological sequences for TCI funerary contexts (Osteria dell’Osa, Tarquinia, and Veio; left: relevant portion of correlations from a recent comparative study, adapted from Pacciarelli 2001:277; right: alternative reading of the sequences highlighted in red, adapted from Bartoloni and Nizzo 2005:423, table A; note both absolute and relative discrepancies).*



The relative structural plausibility of reconstructed networks can be used to further characterize the tempo of vernacular change within these broad periods. I demonstrate the potential of this strategy using data from Osteria dell’Osa, which represent the most complete and unbiased funerary sample from TCI. This important context is described in detail in the phase-specific chapters. For the purposes of this demonstration, however, some preliminary observations are warranted. Despite disturbances due to agricultural work, illegal building, and the construction of a road, the cemetery was sufficiently well preserved to allow for reliable estimates of its extent and internal articulation. Excavations within all major spatial subdivisions yielded over 600 out of an estimated total of 1200-1800 depositions (Bietti Sestieri 1992:76-102). Although this sample ranges chronologically from the beginning of the PF down to the sixth century, it is heavily skewed toward earlier phases. A period of intensive activity in the PF 1, with approximately 450 excavated burials, seems to have been followed by a significant drop during

the PF 2, represented by less than 100 burials, after which the cemetery saw only sporadic use. According to traditional chronologies, the PF 1 in this area was articulated into two main subphases spanning roughly 130 years (Latial culture IIA, 900-830, and IIB, 830-770, often further subdivided), while the PF 2 covered 40-50 years (IIIA, 770-740, and IIIB, 740-730/720).

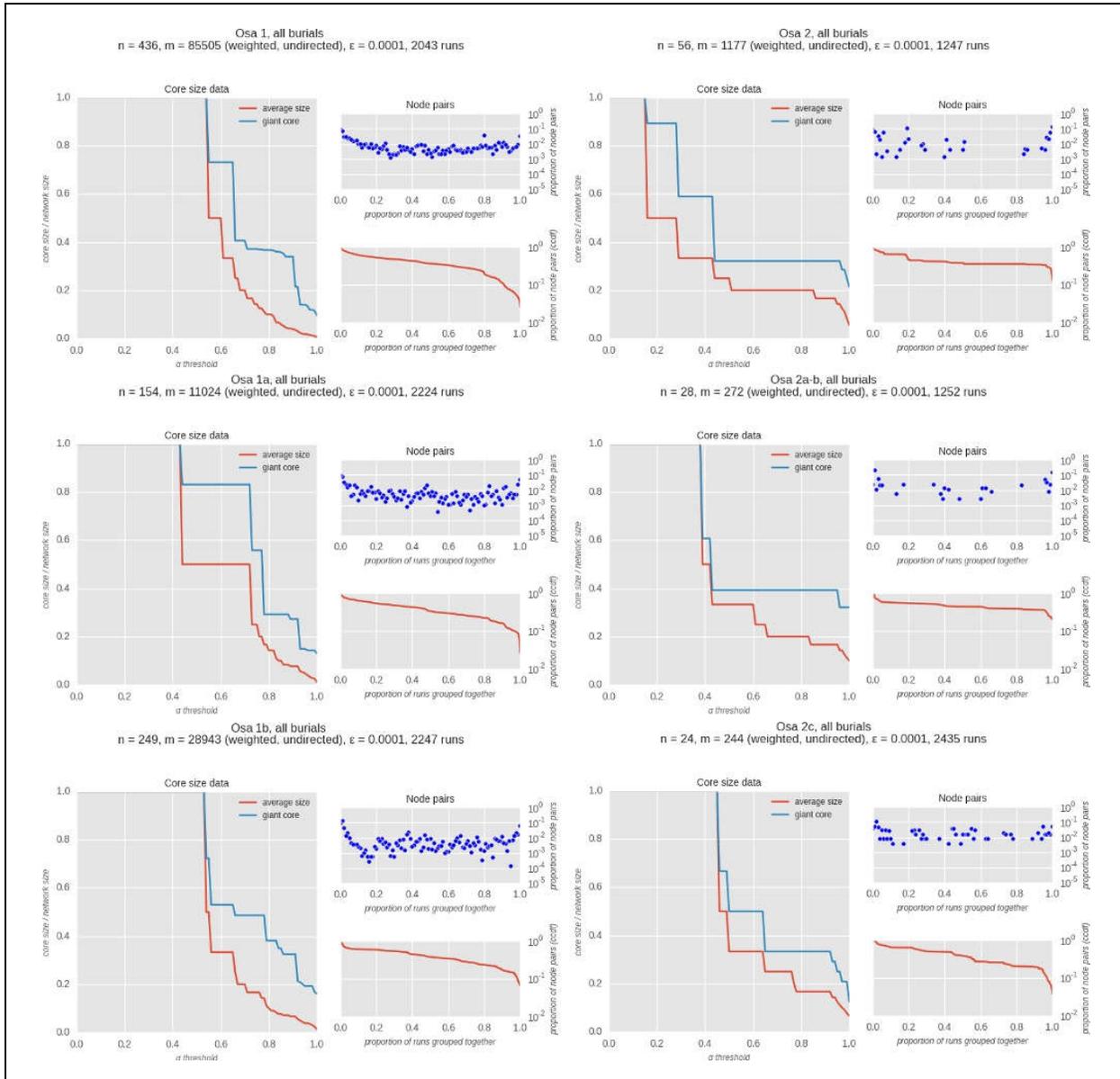
The compilation of data from this sample exemplifies the procedure followed in the rest of the work. Each burial was assigned a unique node identifier and entered into a database along with published information on the age and sex of the interred individual(s) (contextual and bioarchaeological determinations coded separately), disposal mode (cremation or inhumation), chronological attribution(s), state of preservation, membership within hypothesized subunits, names of the burial ground and nearest emerging center (in the case of Osteria dell'Osa, Gabii), and all associated material culture. Pots were classified according to functional categories defined jointly by representatives from major research projects carried out within TCI up to the late 1990s (Cocchi Genick 1999). For most other objects, only generic determinations of intended or primary function were recorded (e.g., spindle whorls versus loom weights).

Six networks were generated covering temporal spans at various levels of resolution within traditional chronologies—all PF 1/Osa II, all PF 2/Osa III, and then PF 1a/Osa IIA, PF 1b/Osa IIB, PF 2a-b/Osa IIIA, and PF 2c/Osa IIIB. The structure of these networks reveals remarkable trends (fig. 2.8). Within the PF 1, the reconstruction based on all burials appears most plausible, followed by the PF 1a and PF 1b subsets. In the PF 2, the situation is drastically different. The reconstruction based on all burials lacks much of the expected mesoscalar structure, so that viewed in isolation it might be supposed that the sample is too small, among other potential issues (54 burials with clay objects versus 436 for the PF 1).

Alternatively, given that the community cores approach has been tested on networks of considerably different size and density (cf. fig. 2.3; on the smaller end of the scale, the canonical karate club network of 34 nodes and 78 edges; Seifi et al. 2013), it might be concluded that the concept of mortuary vernaculars is simply not applicable to PF 2 Osteria dell'Osa. In combination with the PF 1 patterns, this would point to a compelling narrative. Over the two centuries preceding the emergence of Gabii and other major centers within southern TCI, as political and economic inequalities deepened and became institutionalized, patterns of interaction

refocused on correspondingly more circumscribed bases. Along with other manifestations of this process, the sorts of sustained dynamics that might support vernacular relations began dissipating during the PF 1a, if not earlier, so that by the PF 2 they had been relegated at most to a vestigial role.

FIGURE 2.8 Network representations of burials from *Ostera dell’Osa* (from left to right and top to bottom, PF 1/Osa II, PF 2/Osa III, PF 1a/Osa IIA, PF 2a-b/Osa IIIA, PF 1b/Osa IIB, and PF 2c/Osa IIIB).



The PF 2a-b and PF 2c plots paint a far more complicated picture. Both networks recover some of the expected articulation between the extremes for core sizes and p_{ij} distributions. On the

whole, sample size and concentration, edge density, and similar measures do not appear to determine community core organization in these networks. Temporal resolution, however, may be a key factor. The intervals associated with plausible structure shrink over time from 130 years for the PF 1 to 30 for the PF 2a-b and 10-20 for the PF 2c. Further work is required, but it may be that the subphase networks display more convincing patterns than the PF 2 as a whole precisely because of their shorter chronological spans. As discussed in chapters 6 and 7, in fact, several independent lines of evidence point to discontinuities in the developmental trajectory of nearby Gabii.

These examples suggest that quite a lot of information can be gleaned simply by examining core structure and p_{ij} distributions. Still, it is one thing to note evocative trends and quite another to understand their relational implications. In the following section, I outline the procedures of a computer program designed to test the association between community cores and independent variables such as the sex and age of interred individuals, when known, and the chronological and spatial affiliations of burials.

4. SIGNIFICANCE OF COMMUNITY CORES

The problem of evaluating the relational implications of structural patterns is at the forefront of research on complex networks. In the wake of enthusiasm spurred by the publication of highly scalable detection algorithms, recent contributions caution against putting too much faith in the real-world significance of topological communities (see Hric, Darst, and Fortunato 2014 and references at the beginning of section 2.3). Many measures of similarity developed within information theory and related fields may be used to compare communities to independently defined groupings of nodes (e.g., Danon et al. 2005). In order to facilitate the evaluation of results, however, I rely on standard tests of statistical association, which have also been deployed successfully for this purpose (Seifi et al. 2013:93 ff.).

In light of the need to evaluate a large number of reconstructions, I wrote a program that automates most aspects of the statistical analyses. Given a network representation, community cores are extracted for all α thresholds from zero to one, with an increment of 0.01. For every possible pairing of a threshold with an independent variable (e.g., threshold 0.01 and age, then

sex, phase, subphase, etc.), contingency tables are constructed pitting each core at that threshold versus each category of the independent variable (for example, given a threshold characterized by a total of four cores and a division of the sample into subadults, adults, and mature individuals, 12 contingency tables would be constructed to evaluate the impact of age). The significance of association is then calculated at the 0.05 level using Fisher's exact test (in order to account for the large number of tests, the Bonferroni correction is applied; see MacDonald and Gardner 2000). Finally, trends of association beyond binary significance are analyzed using indicators such as phi coefficients corrected for maximum values and adjusted residuals (for the utility of phi/phi_{max}, see Davenport and El-Sanhurry 1991; for adjusted residuals, Sharpe 2015).

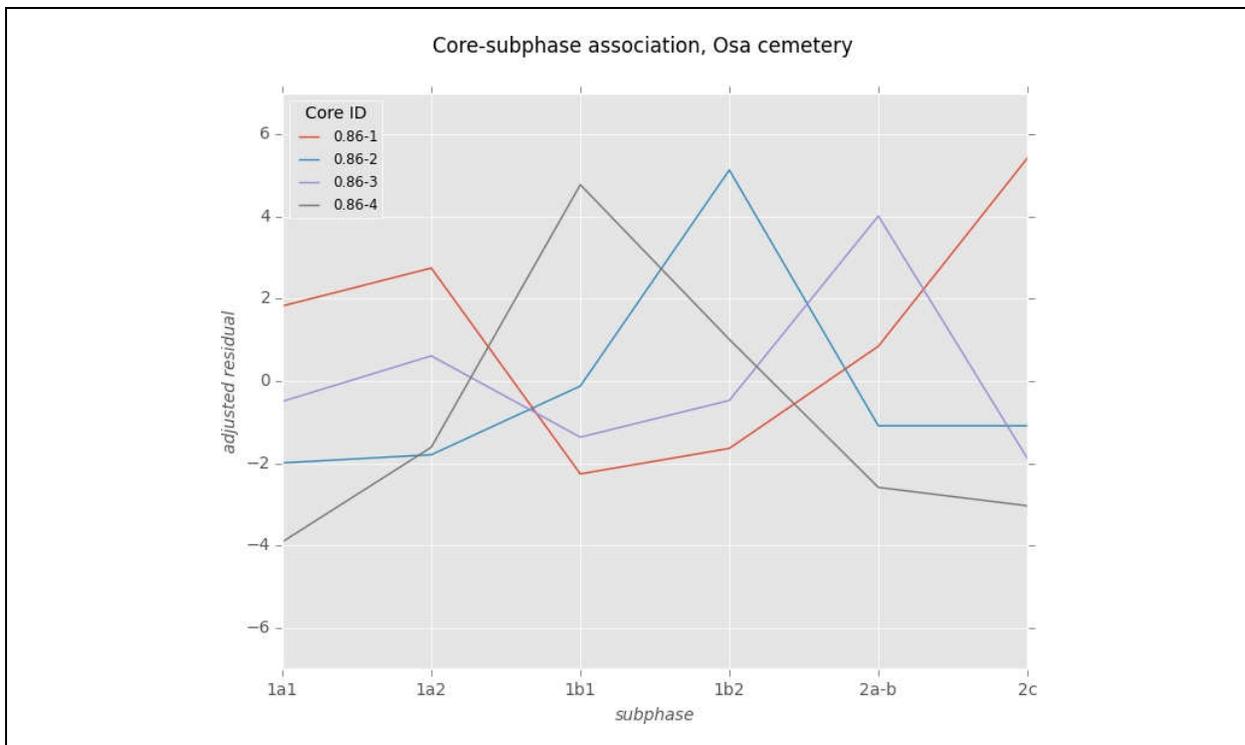
In addition to evaluating variables such as sex, age, and chronological and spatial affiliations, this approach is used to examine the composition of the burial assemblages encompassed by each core. Depending on the specific patterns of assemblage size and diversity characteristic of a sample, topological communities may capture multiple 'grammars' of pots and other clay objects. An interesting feature of the community cores procedure, moreover, is that pairs of nodes that are not connected to one another but similarly connected to other nodes in the original network can actually end up with high p_{ij} values (see Seifi et al. 2013:91-92). Cores may thus encompass an even broader range of assemblage grammars than the topological communities on which they are founded, and parsing these object configurations is essential for evaluating their relational significance. Accordingly, the program computes the association between cores and individual objects, pairs, and so on up to combinations of five items.

These procedures can yield a very large volume of data. With few exceptions, the analysis of each network considered over the course of this research involved between 150,000 and 200,000 contingency tables, and many more networks were analyzed than are discussed in the text. Very large or very small cores tend not to be significantly associated with any independent variable, of course, but compelling patterns may be found at many α thresholds.

Considering again the dataset from Osteria dell'Osa, it becomes interesting to evaluate whether the broad temporal trends discussed in the preceding section may be dissected in terms of the development of individual cores. The fact that the PF 1 as a whole displays more coherent community core organization than its subphases, for instance, need not imply that mortuary

vernaculars were static for over a century. In fact, cores within a network based on all PF 1 burials display interesting chronological patterns even beyond the level of the PF 1a and PF 1b subphases (fig. 2.9). The regular peaks and valleys of core association are striking. In light of the fact that PF1a burials are closer to those of the PF 2 than the PF 1b, these cores might appear to capture the cyclical recurrence of certain assemblage configurations. Alternatively, the relative indeterminacy of PF 1a associations could suggest that the highest level of resolution within traditional chronologies should be revisited.

FIGURE 2.9 Association between community cores and subphases of the PF 1 at Osteria dell’Osa (threshold 0.86 resulted in the highest proportion of significant core-subphase comparisons; the plot displays patterns of association for the largest core associated with each chronological subdivision).

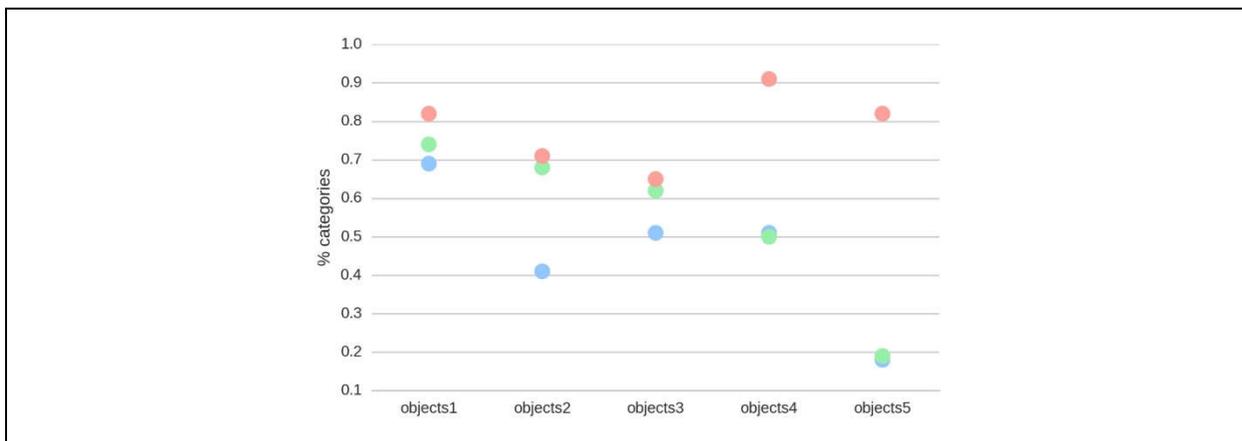


Understanding these patterns would require careful study of all nontrivial cores at multiple thresholds and comparison with other burial grounds. This illustration is intended simply to demonstrate that networks generated as described in section 2.3 supply a much more interesting evidentiary base than might be expected given the limited information they encode. It should be remembered that the networks are derived from patterns of co-occurrence of coarsely classified clay objects, while chronological subdivisions within TCI were defined through comprehensive studies of all aspects of burial assemblages, including metal items, in relation to material culture

from non-funerary contexts. Consequently, it would have been surprising to detect even a small number of weak correspondences between the two. Instead, patterns of association appear so strong and articulated as to raise the possibility of corroborating or refining traditional chronologies on the way to pinning down appropriate temporal spans for reconstruction.

It is hard to imagine what sorts of regularities in the composition of clay-object components of assemblages could give rise to such apparently meaningful patterns of connectivity. In general terms, the community cores algorithm appears more sensitive to the signal of complex object configurations than conventional clustering approaches. Without exception, for samples ranging from all published TCI burials to select phases and sites, community cores are significantly associated with higher percentages of length-4 and -5 object combinations than clusters produced by either average linkage or Ward’s method (using Jaccard and Euclidean distances, respectively; performance is either comparable or better for single objects up to length-3 combinations). For several subsets, the difference is dramatic, with the cores algorithm detecting the signal of twice to four times as many combinations (fig. 2.10).

FIGURE 2.10 Percentages of single objects up to length-5 combinations significantly associated with at least one cluster (red: community cores algorithm; blue: average linkage using Jaccard distances; green: Ward’s method using Euclidean distances; data from all published PF 2 burials from TCI).



This is not to imply that subsequent chapters will reveal clay-object ‘fingerprints’ for specific chronological phases and spatial subsets that were somehow missed by more intensive studies. When considered in isolation, most of the object configurations significantly associated with cores but not other clusters supply little or no additional information about the burials that contain them. This may actually point to a major strength of the community cores algorithm.

Certain object configurations may seem to be distributed randomly within a sample, but patterns of connectivity that would lead burials containing them to be grouped together at various α thresholds may reflect temporally or spatially circumscribed dynamics of interaction. On the whole, then, community core membership really does seem to amount to something other than a simple index of assemblage similarity.

Ideally, analyzing patterns of association between cores and independently defined burial groupings will suggest that chronological and demographic imbalances among burial grounds are not the primary determinants of network structure. Based on the theoretical considerations presented in sections 2.1 and 2.2, I expect aggregate networks to reflect spatial variability in mortuary vernaculars, or in other words patterns of default practice shaped by the relative intensity of interaction between different spatial subsets. Even if the logical grounds for network reconstruction are accepted, however, it seems desirable to test this expectation by comparing summary measures of affinity to more straightforward indicators of interaction. This would constitute a substantial research effort of its own, but it may be worthwhile at least to begin working in that direction.

Linguistic vernacular variability is usually explained as a function of the intensity of direct contact: “the forces that create such deep divisions in the speech community must indeed be powerful. [...] the major factor that is operating here is the amount of communication” (Labov 2014:17-18). Within archaeology, the permanent or semi-permanent relocation of individuals represents perhaps the most securely traceable form of direct spatial interaction. Isotopic analysis of human remains—particularly $^{87}\text{Sr}/^{86}\text{Sr}$ ratios in tooth enamel—can often be used to determine whether individuals were buried in a location different from that in which they spent their early life, providing fine-grained data concerning long-term residential changes (e.g., Bentley 2006; Slovak and Paytan 2011; Price et. al 2015).

TCI is well suited for this work. During the period under consideration, settlements seem to have been largely self-sufficient in terms of subsistence, reducing the risk of interpreting isotopic variability linked to diet in terms of mobility. With regard to animal exploitation, for instance, the available evidence suggests small-scale, household-level herding throughout the BF and well into the PF, with demands connected to increasing population levels met in large part by more

intensive pig raising (Tagliacozzo 1992; De Grossi Mazzorin 2004). Locally exploited food resources, moreover, grew and fed on a variable geological substrate. Although existing studies of the geochemistry of the region are coarse, the territories of neighboring communities seem to have been characterized by distinguishable isotopic signatures (e.g., Killgrove 2010:214-2,15, figs. 8.6-8.7). This raises the prospect of tracking geographical origin even in the case of short-range relocations.

Because of the expenses associated with isotopic analysis, it would be impractical to sample all burial grounds considered in chapters 4-6. Nevertheless, even targeted sampling of key sites and phases can lead to important insights, especially if it is possible to compare values from human remains to local ranges associated with less mobile species (Bentley, Price, and Stephan 2004; Bentley and Knipper 2005). In order to explore this possibility, I sampled 104 individuals buried at the important cemeteries of Quattro Fontanili and Osteria dell'Osa between the late PF 1 and PF 2 as well as 28 pig and rodent teeth from roughly contemporaneous stratigraphic units at five sites across TCI.

Due to bureaucratic delays in obtaining the samples and unforeseen circumstances at the laboratory that conducted the analyses, I have only received data for 46 individuals from each cemetery. As a result, for now I will not be able to engage in the sort of detailed study of late-PF mobility trends and integration practices I originally envisioned. Fortunately, many of the burials for which I have received results are also associated with suitable assemblages for network reconstruction. In the next chapter, therefore, after introducing average p_{ij} values as potential summary measures of relational affinity, I discuss how their appropriateness can be assessed by comparison with isotopic determinations of geographical origin. The isotopic results and outcomes of the comparisons are presented in chapter 7.

CHAPTER 3: MEASURES AND EXPECTATIONS

Prominent figures in the study of late-prehistoric TCI—particularly those trained by the prolific Italian protohistorian Renato Peroni—have stressed the distinction between historical-diffusionist perspectives, which tend to trace the emergence of large social collectives to the catalyzing influence of contact with eastern Mediterranean groups, and the recognition of at least partially autochthonous developments inherent in the ‘protourban’ model introduced in section 2.1 (e.g., Guidi 1982, 2002, 2006; Pacciarelli 2009, 2010). When it comes to accounts of specific phases and regions, the literature on TCI can be nuanced, so that it is often difficult to pin down the causal mechanisms implied by competing models. Still, it is clear that many syntheses ultimately characterize the emergence of large social collectives within TCI and elsewhere in Italy and western Europe more broadly as a ‘secondary’ phenomenon spurred by long-distance exchange (for the distinction between ‘primary’ and ‘secondary’ formations, see Fried 1960; Service 1962; Price 1978; Marcus and Feinman 1998 and 2008; Scheidel 2013; for examples of practical applications, Joffe 2002; Braswell et al. 2004; Parkinson and Galaty 2007). This is evident in the work of specialists, beginning with Peroni himself, as well as non-specialists:

In geographic terms, the expansion of activity throughout the Mediterranean [in the early first millennium] opened up a new hinterland, especially in southern temperate Europe [...]. This enhanced the importance of Italy as a junction between Mediterranean maritime routes and land routes into Europe, leading ultimately to the emergence of Rome (Sherratt and Sherratt 1993:363)

It should not be forgotten that the ‘barbarian’ Europe of the 3rd, 2nd, and 1st millennia BCE developed *in the presence* of a world set apart by a far higher level of civilization and entirely different forms of social organization, that of the Near East and the eastern Mediterranean. [...] Obviously the eastern models of social organization would have been entirely unsuited for Europe; still, they must have constantly exercised upon it a suggestive and stimulating effect (Peroni 1996:5, my translation; emphasis in the original)⁴

⁴ “Non va infatti dimenticato che l’Europa ‘barbarica’ del III, II e I millennio a.C. andò realizzando i suoi sviluppi *in presenza* di un mondo contraddistinto da un livello civile di gran lunga superiore e da forme di organizzazione sociale totalmente diverse, quello del Vicino Oriente e del Mediterraneo orientale. [...] Ovviamente, i modelli orientali di organizzazione sociale sarebbero stati improponibili per l’Europa; tuttavia essi dovettero esercitare incessantemente su di essa un effetto di suggestione e di stimolo”

It is interesting to note that the most precocious and advanced formation processes of the Villanovan city-states [took place in] regions that already in the BF functioned as hubs within networks of long-distance exchange (Bietti Sestieri 2010:253, my translation)⁵

Even contributions that emphasize the importance of autochthonous developments, such as those cited at the beginning of the preceding paragraph, stop short of dismissing the notion of ‘secondary’ processes altogether. The argument is not that states/cities/city-states emerged autonomously in TCI but that the external catalysts were attracted to Italy in the first place and were so effective because local groups had attained just the right level of ‘Complexity’ around the BF-PF transition:

The consolidation of the ‘Etruria system’ [...] plausibly played a leading role in the gradual economic take-off of many regions of the Italian peninsula [...], a process to which the pre- and protocolonial Greek communities and the Levantine partners who interacted with them were attracted and then contributed. This take-off enabled the affirmation and spread of urban civilization, both in the areas of primary diffusion of protourban phenomena and in some sectors that were marginal with respect to them (Pacciarelli 2009:394, my translation)⁶

As this passage also demonstrates, the reaction against diffusionism is largely directed at models rooted in the purported influence of eastern elements. With regard to variability in the tempo and scale of regional developments within Italy itself, the idea of ‘trickle-down Complexity’ goes almost entirely unquestioned. This is especially evident in comparisons of developmental trajectories in northern versus southern TCI: “in the face of the ‘Villanovan revolution’, in connection with which Veio emerged on the right bank of the Tiber, the Latins set off a new ordering of the landscape [...]: they occupy for the first time or substantially strengthen ‘frontier’ sites [...]. Within this new settlement pattern, Fidenae and Crustumerium emerge directly as protourban centers” (di Gennaro and Amoroso 2010:307, my translation; cf. di Gennaro and Guidi 2009b; Pacciarelli 2009:399 on the “higher stakes” that spurred social developments in northern TCI compared to the south).⁷

⁵ “È interessante notare che i processi più precoci e più avanzati di formazione delle città-stato villanoviane non si verificano nelle aree più ricche di risorse minerarie [...] ma piuttosto nella pianura padana centro-orientale (Bologna) e in Etruria meridionale, due regioni che già nell’età del bronzo finale funzionavano come punti nodali di reti di scambio a lunga distanza”

⁶ “Il consolidamento del ‘sistema etrusco’ [...] ha plausibilmente esercitato un ruolo trainante per il progressivo decollo economico di molte regioni della penisola italiana nel corso dell’VIII secolo a.C., processo in cui sono state attratte e a cui hanno poi contribuito le comunità pre- e protocoloniali greche unitamente ai partner levantini che con esse interagivano. Tale decollo ha reso possibile l’affermarsi e il diffondersi della civiltà urbana, sia nelle aree di prima diffusione dei fenomeni protourbani, sia in alcuni territori ad esse marginali (v. ad es. la Sabina tiberina)”

⁷ “I dati che emergono dalle nostre ricerche consentono di documentare sempre meglio come alla ‘rivoluzione villanoviana’, in relazione a cui nasce Veio sulla sponda destra del Tevere, i Latini reagiscono dando avvio a un

My aim in the following chapters is not to establish whether TCI should be seen as a context of ‘primary’ or ‘secondary’ development. Rather, I want to examine whether taking seriously the notion of social development as a process of experimentation and adaptation within multiple relational planes can render the question altogether inconsequential. In my view, focusing on dynamics within and between social aggregates can open the door for rigorous comparisons of formally different entities and thereby lead to more satisfactory explanations for major changes in developmental trajectories. As noted in chapter 1, TCI represents an ideal case study to examine this perspective. Despite similar starting conditions in the early BF, with few exceptions formally different social collectives seem to have emerged north and south of the Tiber by the PF 2 (for references and examples supporting this summary assessment and others below, see section 1.3 and the more detailed overviews of the available evidence in chapters 4-6).

This chapter outlines how networks reconstructed and analyzed as described in chapter 2 can be deployed to reconsider important aspects of this development. I begin by identifying average p_{ij} values and clustering coefficients as key measures (section 3.1). I then derive expectations concerning 1) the relationship between the BF-PF reconfiguration of settlement patterns and vernacular affinities (section 3.2); 2) the supposed role of changing patterns of long-distance contact as exogenous catalysts for local developmental trajectories (section 3.3); and 3) the possibility that, despite substantial differences in surface area, emerging centers throughout TCI hosted comparable populations (section 3.4). I evaluate these expectations in chapter 7, concluding that the watershed changes attested across the research area can be understood in reference to uniform endogenous processes leading to the emergence of comparable social collectives.

1. KEY MEASURES

Sections 2.3 and 2.4 explained how p_{ij} values can be used to extract a hierarchy of nested community cores from a reconstructed network and evaluate its structural plausibility. The

nuovo ordinamento del territorio [...], prendendo posizione sulla sponda sinistra del grande fiume: occupano ex novo, o rafforzano in modo sensibile, i luoghi di ‘frontiera’ con funzione strategica di Fidenae e Crustumium, a seguito della sistemazione che aveva in precedenza avuto luogo a Roma (sottofase IIB1). All’interno di questo nuovo assetto insediativo, Fidenae e Crustumium nascono direttamente come centri protourbani, mentre Roma conosce fasi di occupazione (fino a tutto il I periodo e ai primi momenti del II) precedenti alla definizione di quella che sarebbe rimasta, salvo successive espansioni, la grande unità topografica dell’abitato”

composition of cores can also provide important information concerning the relative prominence of extraneous variables, which can then be used to isolate problematic components. When it comes to approximating relational patterns, however, the p_{ij} values themselves serve as convenient measures. It may be appropriate to conceptualize the process of iterating a heuristic for the detection of topological communities and tracking the changing relationships between nodes as agitating static data and taking snapshots of the resulting interactions. As summary measures of the simulated dynamics, p_{ij} values can be better indicators of the affinity between nodes than the original edge weights. Accordingly, I rely on averages of these values to gauge the overall strength of affinities within different subsets of a network and relational distances between them.

Some of the expectations derived below also extend to standard measures of topology. The networks based on p_{ij} values may be used to evaluate patterns in the embeddedness of nodes within different subsets. To gauge embeddedness, I use the clustering coefficient, which despite its somewhat misleading name reflects the level of transitivity in a network—i.e., the likelihood of node u being connected to w if u is connected to v and v to w (e.g., Newman 2010:198-201). For a single node in an unweighted network, the local clustering coefficient is given by the number of pairs of neighbors of the node that are connected divided by the total number of pairs of neighbors, and the average of local clustering coefficients for all nodes in a network can serve as an indicator of overall clustering (Watts and Strogatz 1998). Several adaptations of this measure have been proposed for weighted networks (e.g., Saramäki et al. 2007); the version I employ is based on the geometric mean of edge weights normalized by the maximum weight in the network (Onnela et al. 2005).

The appropriateness of interpreting p_{ij} values and the clustering measures derived from them as indices of intensity of interaction hinges in part on the theoretical considerations presented in chapter 2. Additionally, the pilot study of late-PF mobility patterns introduced in section 2.4 may allow for more direct validation. Should it prove possible to distinguish local isotopic ranges for Gabii and Veio, it will be interesting to compare the patterns of affinity associated with burials of ‘locals’—individuals who appear to have been members of the community under consideration since childhood—versus ‘nonlocals’—those who joined the community as young adults or even later in life. Although I think that short-range relocations were a salient dynamic within TCI (see

below and section 7.2), I expect that most of the sampled individuals from both cemeteries will prove to be local. Should this be the case, given the relatively large size and diversity of the samples involved it seems reasonable to assume that most of the non-sampled burials also belong to locals. Based on these considerations, I compute average p_{ij} values for locals against non-sampled burials from the same cemetery and then for nonlocals against locals and non-sampled burials together.

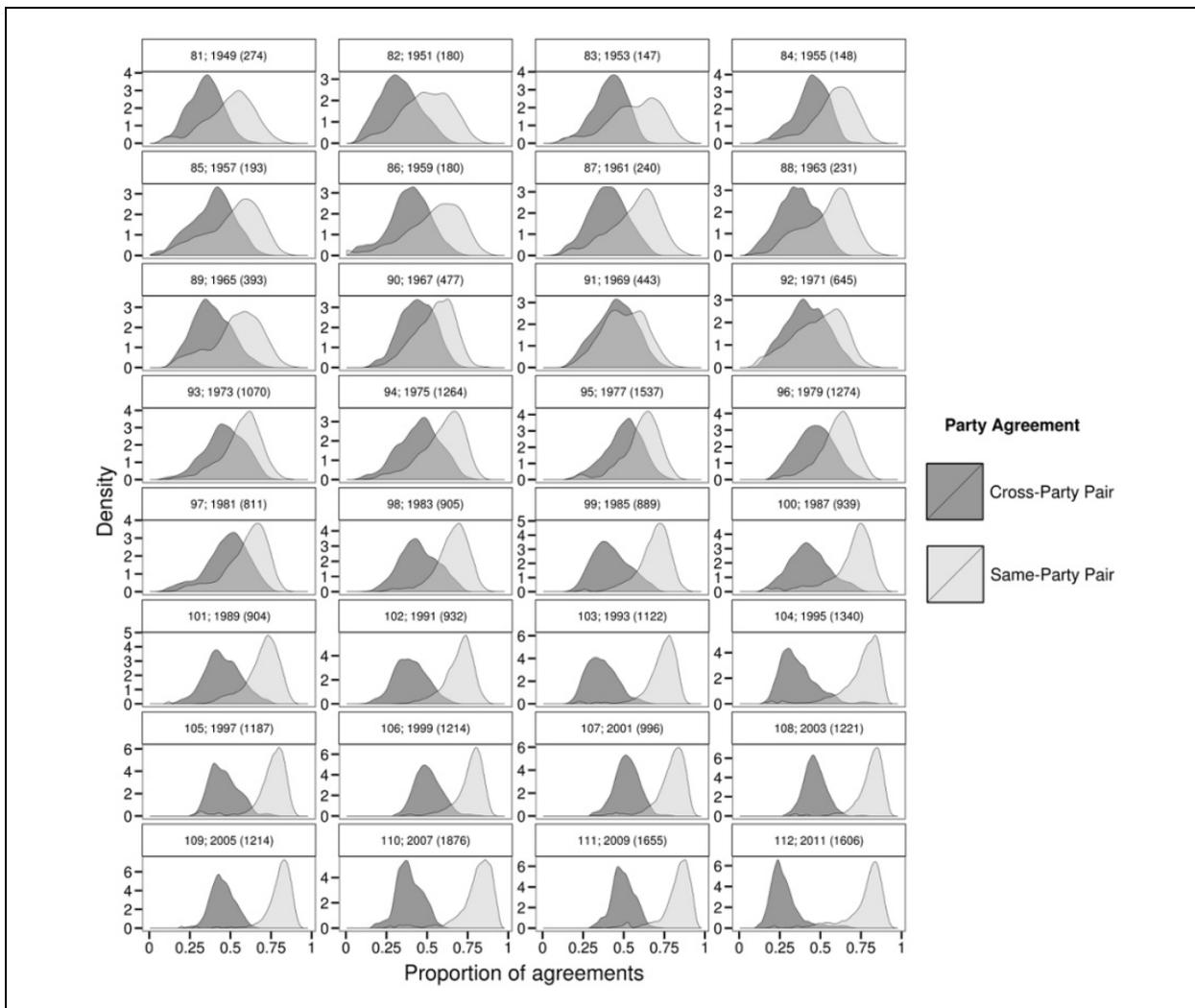
In addition to conducting these comparisons based on the entire p_{ij} range, it is possible to control for underlying relational ‘noise’. Depending on their relative openness and centrality in the late PF, as well as the overall dynamism of predominant circuits of interaction, Gabii and Veio could be characterized by weak local vernacular signals or even lack characteristic patterns of connectivity. This possibility can be evaluated by comparing the distribution of p_{ij} values for intra-subset versus inter-subset burial pairs.

Recently, for instance, the rise of partisanship in the U.S. House of Representatives was tracked by analyzing trends in intra- versus inter-party agreements between 1949 and 2011 (fig. 3.1; Andris et al. 2013). In order to control for overall levels of agreement, a threshold was derived for each Congress such that edge weights around that value are equally likely to belong to intra- or inter-party pairs. Because members of pairs associated with higher values tend to belong to the same party, focusing on patterns in the prevalence of inter-party pairs beyond such thresholds proved particularly informative. In a similar vein, I will analyze distributions of intra- and inter-subset edge weights to identify p_{ij} thresholds beyond which intra-subset pairs become gradually more prominent. I will then repeat the comparison of affinities associated with the burials of isotopically identified locals versus nonlocals using only edge weights above the threshold values.

Several unknowns could affect the results of these comparisons. For example, the isotopic analyses may fail to identify all nonlocals or otherwise be partially inaccurate; proportions of nonlocals within the sample may be lower than in the population as a whole; and/or individuals responsible for the burials of nonlocals may have been native to the community or vice versa, and in any case they may have been more or less attuned to predominant local vernaculars. In light of these and other possibilities, local and nonlocal averages derived from the entire p_{ij}

range could turn out not to be substantially different. Excluding values below the thresholds, however, should result in higher averages for locals. Of course, a scenario in which the burials of nonlocals consistently score higher than those of locals would also be interesting. Still, such results would cast at least partial doubt on the assumption that networks reconstructed as described in chapter 2 may represent more straightforward and robust bases for assessing patterns of vernacular affinity than the distribution of metal objects and other stylistically distinctive categories of material culture emphasized in the literature.

FIGURE 3.1 Probability density functions derived from cross-party and same-party agreement rates within the U.S. House of Representatives (1949-2011; adapted from Andris et al. 2013:10, fig. 1).



2. CHARACTER OF THE BF-PF SETTLEMENT RECONFIGURATION

Multiple lines of evidence suggest the linked factors of demographic growth and intensifying

conflict as primary determinants for the dramatic changes in settlement forms and locational preferences attested between the BF and PF. In the periods leading up to the BF, the number of settlements increased and their location shifted to elevated or otherwise easily defensible topographic features. In the BF, there is evidence for the construction of defensive works and modification of site morphologies aimed at increasing and/or more clearly delimiting the habitable surfaces of suitable features. Most small settlements across TCI appear to have been abandoned between the end of the BF 3 and the beginning of the PF 1. Population converged on larger features, again with a marked preference for defensible morphologies, and there is more substantial evidence for the construction of defensive works. In parallel with these developments, several aspects of the funerary evidence point to changes in patterns of expression of martial status. Compared to other periods, for instance, functional weapons are extremely rare in BF and PF burials, though in some cases they were replaced with miniature representations.

The degree to which the BF-PF reconfiguration of settlement patterns reflects strategically planned responses to intensifying conflict remains an open question. At least in the case of northern TCI, which is regarded as more ‘precocious’ than the south, the choice of very large but still easily defensible volcanic plateaus tends to be interpreted as evidence for a high degree of coordination at or above the level of individual BF 3 communities (e.g., di Gennaro and Guidi 2009b:432; Pacciarelli 2009:400). Especially in light of the likely driver of conflict, however, it is also possible to envision a more organic process.

Members of a given BF settlement need not have converged as one and in orderly fashion upon the closest strategically suitable topographic feature. To cite just one alternative, some individuals and groups could have been more responsive than others to perceived or actual threats, pursuing their idiosyncratic weak ties or even entirely new connections early on as they monitored the situation. In fact, it has been observed for some time that even the large plateaus of northern TCI were not occupied extensively all at once—in most cases there is evidence for habitation on small adjacent features or easily defensible subsections datable to the beginning of the BF or earlier (e.g., Pacciarelli 2001:159-165; cf. section 4.1 and especially fig. 4.7). As the bellwethers gradually seceded, their choices could have variously influenced those of the majority and laggards depending on their position within the community, among other factors. Even within a short timespan, such diverse dynamics could have occasioned superficially orderly

settlement patterns.

There is no way to get at individual strategies and choices. Regardless of specifics, however, the process of population concentration must have had a substantial effect on patterns of affinity within and between different subsets of the research area, so that it seems reasonable to work out expectations for its relational signature under the ‘directed and ‘organic’ scenarios. Over the span of just a few generations, tens of thousands of people relocated from hundreds of settlements distributed evenly across the landscape to a limited range of sites (cf. fig. 4.1; population estimates are discussed in section 7.4). If the relocations were coordinated at or beyond the community level in reference to the strategic potential of local features, if the new areas of concentration took the form of relatively unitary centers in short order, and if these changes occurred slightly earlier in northern TCI, 1) average p_{ij} values for inter-subset comparisons and especially cross-Tiber pairs should remain constant or decrease between the BF 3 and early PF, while 2) intra-subset averages should remain constant or increase. Overall, then, the difference between the two types of averages is likely to increase, with density estimations for the underlying p_{ij} distributions diverging steadily (cf. fig. 3.1).

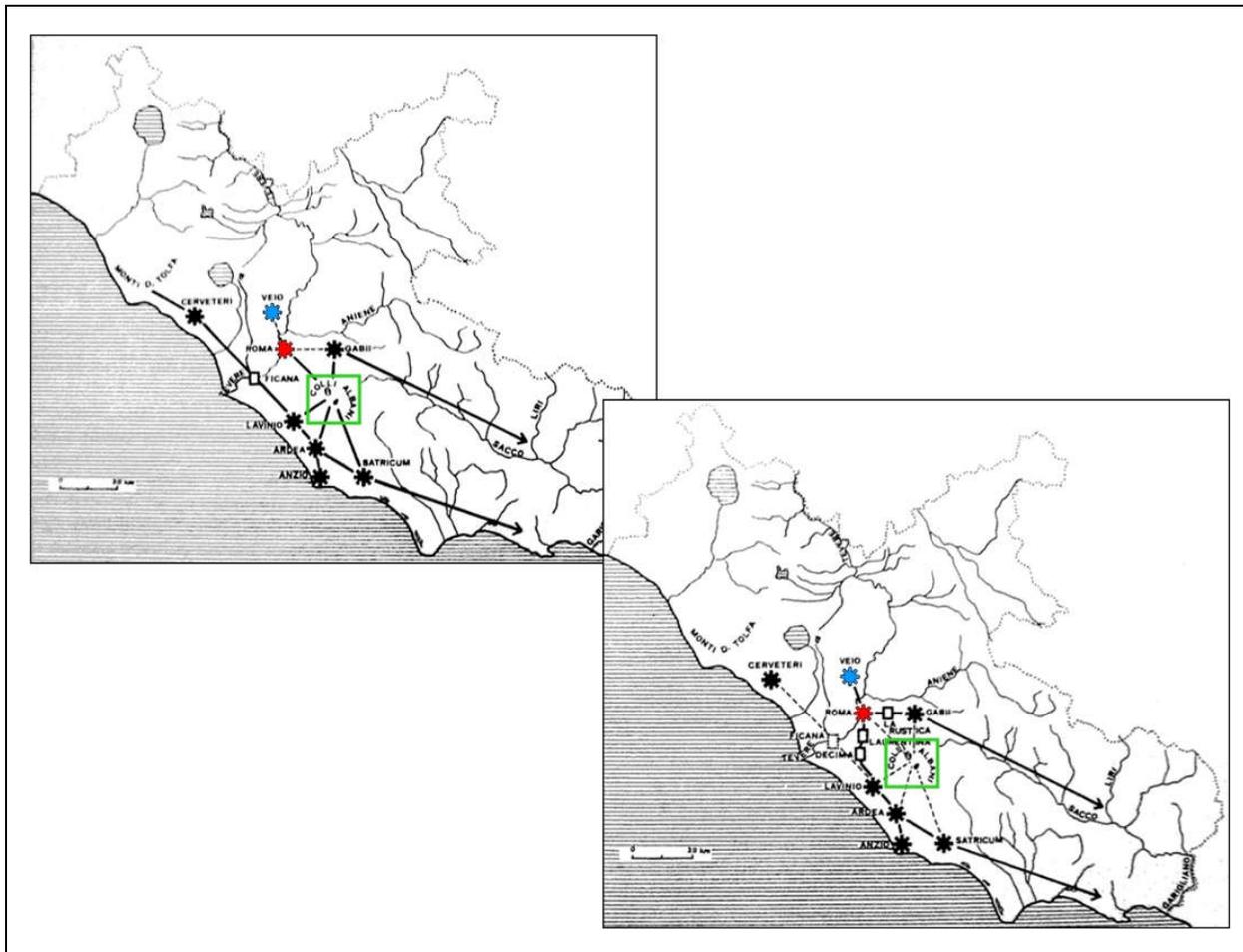
In contrast, given a scenario of more organic patterns of relocation, 1) inter-subset averages—including those associated with cross-Tiber pairs—should spike around the early PF 1, while 2) intra-subset averages should decrease. Consequently, the difference between them is almost certain to decrease or even be eroded completely. Such dynamics would be unlikely to endure for long against a backdrop of conflict. Moving to the later PF 1 and PF 2, patterns of intra- and inter-subset affinity should stabilize, with p_{ij} distributions more closely approximating BF 3 trends. Rather than steadily diverging, therefore, density estimations should converge in the early PF 1 and then again become distinctive toward the end of the PF 1 and PF 2.

3. IMPACT OF LONG-DISTANCE EXCHANGE

As already mentioned, although most specialists assume some sort of feedback between the BF-PF transformations within TCI, shifting axes of long-distance exchange, and patterns of interaction with more ‘Complex’ social entities, few explicit models have been delineated. A notable exception is Anna Maria Bietti Sestieri’s discussion of the ramifications of the rise of

Veio as a hub for routes between the metal-producing areas of the north and southern Italy (Bietti Sestieri 1992:72-75; cf. Bietti Sestieri 2005; Bietti Sestieri and De Santis 2007). The model departs from evaluations of changes in the relative centrality of different parts of the research area that are commonly encountered in the literature (recently, for instance, di Gennaro and Guidi 2009b; di Gennaro and Amoroso 2010). In the late BF and early PF, the Alban Hills in the south and the northern coastal areas of Cerveteri and Tarquinia appear as the most prominent subsets according to conventionally emphasized evidence. By the end of the PF 1 or the beginning of the PF 2, however, the center of mass seems to have shifted toward Veio, which was located close to the Tiber in the interior of northern TCI. As a result, nearby Rome became a point of departure for both coastal and interior routes to the south. In parallel with these changes, the Alban Hills seem to have declined in importance (fig. 3.2).

FIGURE 3.2 *Hypothesized relationship between the relative prominence of TCI centers and major axes of long-distance exchange (top left: BF-PF 1a; bottom right: PF 1b-PF 2; Veio is highlighted in blue, Rome in red, and the Alban Hills in green; adapted from Bietti Sestieri 1992b:74-75, fig. 3.17).*



According to the model, these shifts were connected to the intensification of activity by eastern Mediterranean seafarers along the Tyrrhenian coast, including the establishment of outposts south of TCI, and they provided the impetus for the transformation of Veio, Rome, and select other settlements into the historically attested Etruscan and Latin cities (Bietti Sestieri 1997:73). The patterns illustrated in figure 3.2 thus represent an ideal point of departure for assessing the impact of long-distance exchange and interaction with eastern Mediterranean groups on TCI developmental trajectories.

Although many important sites are not associated with suitable funerary data for network reconstruction, it should be possible to evaluate expectations concerning three general aspects of the model: 1) in the BF 3, the Alban Hills subset should exhibit the strongest connections with the northern coastal areas of Cerveteri and Tarquinia; 2) in light of the privileged connection between Veio and Rome, the associated relational averages should increase or remain constant over the course of the PF 1 and PF 2, and they should exceed those between Rome and the coastal areas of northern TCI; finally, 3) over the course of the PF the gradual dissolution of direct connections between northern TCI and southern subsets occasioned by the consolidation of the Veio-Rome channel should translate into diminishing averages for cross-Tiber pairs not involving Rome.

In addition to casting doubt indirectly on the role of long-distance exchange and exogenous influences as catalysts for social development within TCI, deviation from these expectations would call into question the nearly universal characterization of processes south of the Tiber as derivative of the north. As I already indicated, I find the notion of ‘trickle-down Complexity’ teleological and unsatisfactory. Nevertheless, in light of the apparent asymmetries in scale that differentiate northern and southern developmental trajectories, with few exceptions, it is admittedly difficult to envision a plausible alternative.

In section 7.4, I consider the possibility that emerging centers across TCI may have been much more similar in substance than suggested by their formal diversity. In particular, I argue that a coherent account of social development within the research area can only be obtained by assuming that even the largest PF 1 centers north of the Tiber hosted comparable populations to those of the south, which on average occupied much smaller surfaces. As highlighted in the

following chapters, there is some tantalizing evidence in support of this assumption, but due to the scarcity of settlement excavations it is not definitive. Accordingly, I conclude this chapter by discussing how the internal dynamics suggested by vernacular relational patterns may be deployed as proxy indicators of relative settlement densities.

4. SUBSTANCE OF THE NEW CENTERS

Recent work on the evolution of well-documented complex networks suggests that density tends to increase over time (i.e., the number of edges grows superlinearly in the number of nodes; Leskovec, Kleinberg, and Faloutsos 2007). In a context characterized by more or less long-lived and insular settlements, therefore, intra-settlement network densities and related measures might be expected to vary substantially. At least in the early PF, TCI was not such a context. Barring a rigidly planned and directed process of nucleation (see above, section 3.2), it seems reasonable to assume that shortly after their formation the new centers would have been characterized by similar patterns of connectivity.

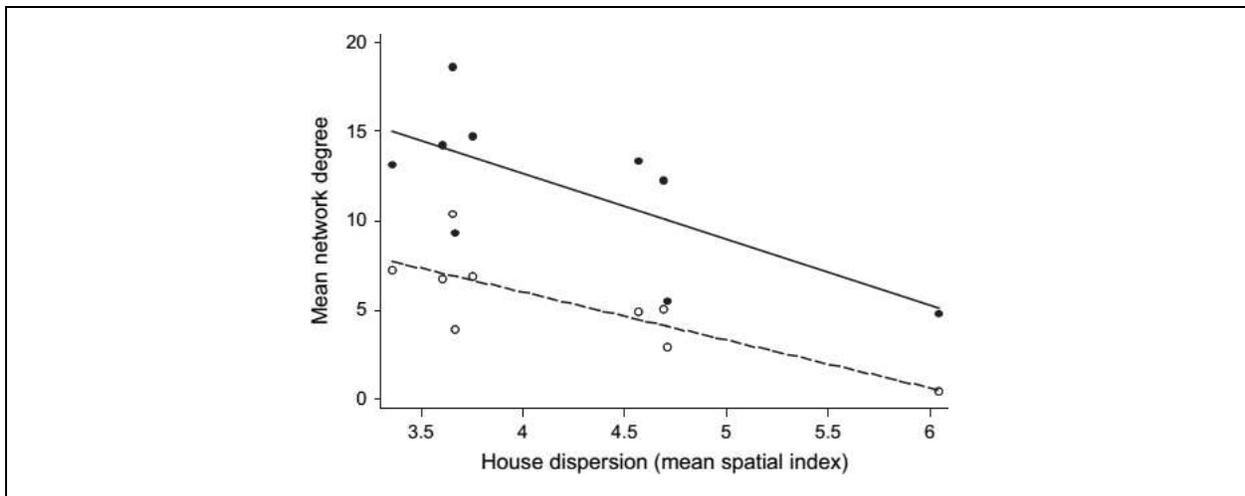
The rate of densification of the underlying networks, however, could have varied depending on a variety of factors—first among them intensity of occupation. In general, the denser the distribution of individuals and groups upon a newly settled feature, the higher the rate of face-to-face contact, and the higher the rate of such contact, the greater the potential for sustained social relationships of the sort that might be captured within a network dataset. Of course, beyond certain thresholds demographic concentration can lead to increasing factionalism and ultimately render communities unstable. In fact, in my view these were determining factors for the process of settlement reconfiguration itself and may have again become relevant toward the end of the PF 1 and in the PF 2. In this section, however, I am concerned only with the period immediately following the formation of the new centers.

As illustrated in the following chapters, the newly occupied features ranged in surface area from approximately 20 to 175 hectares. Survey and limited excavation evidence, moreover, point to discontinuous patterns of occupation, with dense concentrations of habitation traces separated by relatively ‘empty’ areas. Presumably, extended families and/or other corporate groups lived in closely spaced structures separated from one another by activity areas, animal pens, gardens, or in the case of the largest plateaus perhaps even relatively large agricultural plots (e.g., Pacciarelli

1991). Even so, most researchers assume that more extensive habitable surfaces imply larger populations, or in other words that settlement densities were broadly comparable across TCI (cf. section 7.4). If the proposed relationship between settlement density and rate of network densification is accepted and assuming that p_{ij} values derived from the reconstructed networks really do approximate relational affinities, it seems reasonable to argue that comparable settlement densities should be evident in a lack of correlation between the measures described above and the total extent of defensible settlement surfaces.

In light of the geomorphological heterogeneity of TCI, however, if the new centers developed from broadly comparable starting conditions under similar pressures, settlement density could have varied depending on the topography of suitable features. Southern TCI was largely devoid of the extensive, flat, and well demarcated plateaus characteristic of parts of the north. Instead, most of the new centers seem to have developed around preexisting villages located on the largest hills and promontories. Defending settlements situated on less defined features would have presented significant challenges, which could have been met through proactive mechanisms for gathering, sharing, and acting on information, investment in defensive works, or both, among other strategies. Regardless, the associated costs would have been higher the more extensive the settlement area, providing an incentive for greater concentration. According to this possibility, the density and average clustering of intra-subset networks should be negatively correlated with the surface areas of settlements (cf. fig. 3.3).

FIGURE 3.3 Relationship between mean degree and measure of settlement density observed within rural villages in modern Ecuador (filled circles/solid line: general contact network; unfilled circles/dashed line: food-sharing network; adapted from Bates et al. 2007:1092, fig. 1).



Some of the expectations outlined in this section may seem unrealistic in the context of archaeological data. If so, the presentation of the available evidence in chapters 4-6 may deepen this skepticism. Still, although in some cases the data are far from satisfactory (e.g., for the BF), on the whole summary measures extracted from the reconstructed networks combine to suggest credible relational trends. More fundamental, in the course of addressing concerns about the supposed incompleteness and ambiguity of archaeological evidence I pointed out that techniques developed for the analysis of complex networks in many cases were designed precisely to exploit approximation and multivalence. The relational averages and other measures on which I rely almost always represent hundreds or thousands of systematic burial-burial comparisons derived from thousands of iterations of the base community detection algorithm.

Aside from acknowledging methodological concerns, I end this chapter with the issue of approximation in order to clarify a semantic issue. In section 2.2 I emphasized that I do not view burials or their network representations as proxies for individual social actors. Accordingly, when I argue that ‘nonlocals’ should be associated with lower p_{ij} averages than ‘locals’, for instance, I am not implying that such measures can pinpoint the absolute degree of integration of individual burials, let alone the geographical origin of the associated persons. Again, I am referring to general trends inferred from distributions of hundreds or thousands of averages, which for the purposes of evaluation are displayed in full or further approximated through bootstrapping and illustrated along with confidence intervals.

CHAPTER 4: TERMINAL BRONZE AGE (BF)

Until the second half of the 20th century, the Bronze Age over much of TCI was virtually unknown. Materials from the period had been described in publication for over a century, but they were usually attributed to the PF. A survey article on the archaeological evidence from the territories of Tolfa and Allumiere (northern TCI), which as discussed below are associated with some of the largest clusters of funerary data from the BF, attributes only two objects to the Bronze Age and remarks that the period “is more or less absent over much of Etruria, where the Iron Age seems to overlie directly the Copper Age” (Bastianelli 1942:231, my translation).⁸

Especially with regard to the final stages of the Bronze Age, the situation has changed drastically in recent decades. Two broad phases are recognized—the BF 1-2, approximately 1150-1050, and the BF 3, 1050-950/925, or down to 900 according to traditional chronologies (cf. fig. 2.8). The outline of major spatial subsets in section 4.1 will highlight rather heterogeneous lines of evidence, but some general trends can be recognized across TCI (e.g., Pacciarelli 2001:89-93, 98-108; Bietti Sestieri 2009; Barbaro 2010).

The BF 1-2 settlement and funerary evidence is comparable throughout the research area, and some specialists even hypothesize an essentially common ‘culture’ extending beyond the confines of TCI (e.g., to Campania in the south; Bietti Sestieri 2009:15). Although a preference for locating settlements on easily defensible features can be detected at least as early as the Middle Bronze Age, in the BF 1-2 it intensified. Most villages were less than five hectares in area, but a few outliers extend the range to around 15 hectares or more both north and south of the Tiber. The funerary evidence is limited to small burial grounds that are rarely associated with specific sites. Cremation dominates the record, and assemblages tend to be simple.

The BF 3, in contrast, has been characterized as encompassing the beginnings of cultural

⁸ “Come è noto, [l’età del bronzo] è pressochè assente in gran parte dell’Etruria, ove sembra che l’età del ferro si sia sovrapposta direttamente a quella eneolitica”

differentiation between ‘Etruria’ and ‘Latium’. Such assessments are rooted first and foremost in the funerary evidence (Bietti Sestieri and De Santis 2012:636-640; Iaia and Pacciarelli 2012:342-346). Southern TCI burial assemblages appear more standardized, so that within traditional chronologies the BF 3 is identified as the first phase of a regionally homogeneous ‘Latial culture’. Nevertheless, it has been pointed out that this apparent divergence may have been overemphasized in deference to historically documented ethnolinguistic boundaries (at least relative to underlying commonalities that distinguish TCI as a whole from neighboring areas; e.g., Peroni 1996:344-347).

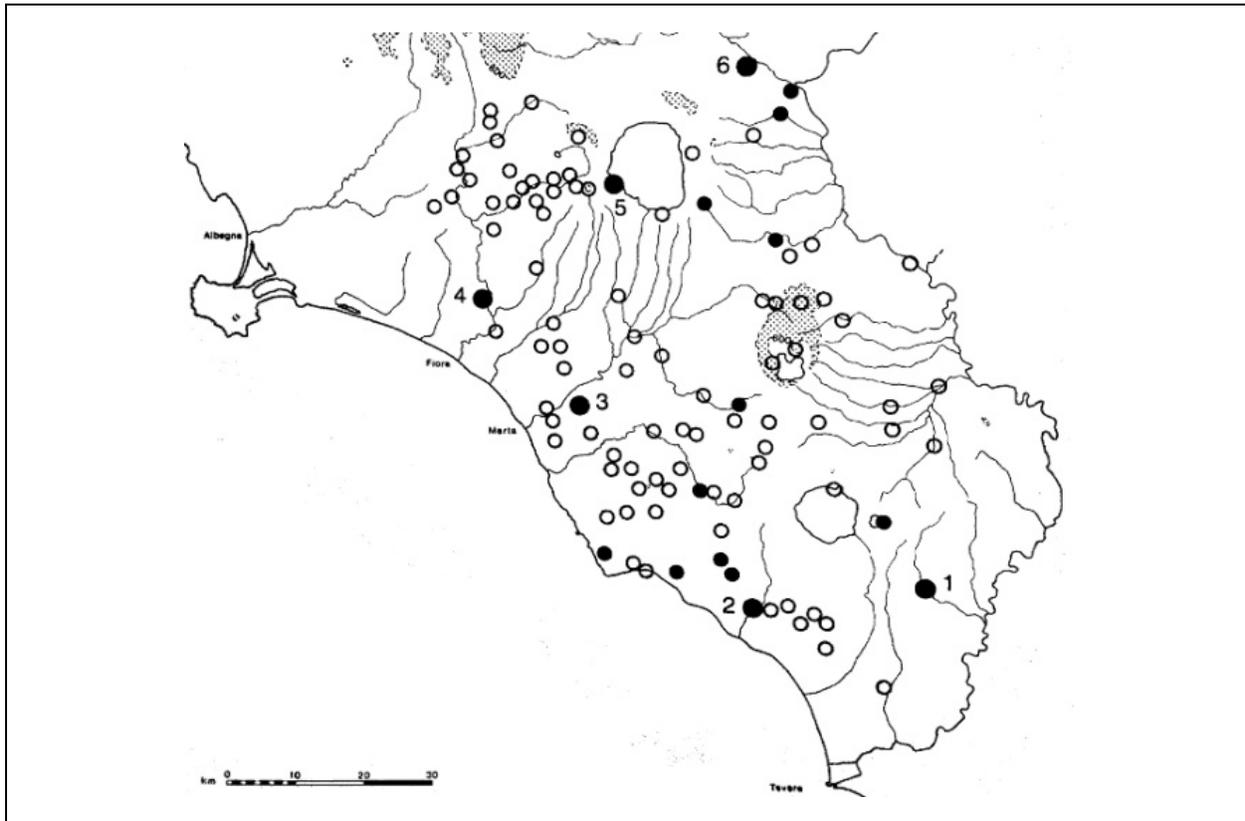
Aside from their ‘cultural’ connotations, documented funerary areas still appear relatively small and irregularly distributed in relation to settlements. As a result, it is frequently assumed that formal burial treatment was restricted to prominent individuals or at most select social categories (e.g., Bietti Sestieri 2009). While it is likely that factors other than just preservation and recovery biases are in play, it should be noted that most of the evidence derives from excavations carried out in the late 19th and early 20th centuries; more recent work suggests that several burial grounds were larger than previously thought (e.g., Barbaro 2010:132).

In terms of habitation patterns, by the final stages of the BF population seems to have converged in the immediate vicinity of the topographic features that housed the PF centers. Perhaps due to more systematic survey efforts, this development is most evident and tends to be described as slightly more precocious within northern TCI (fig. 4.1), though recent contributions have begun questioning this assessment (e.g., Fulminante and Stoddart 2010). In any case, materials from settlement contexts do not suggest a sharp divide between north and south (e.g., Bietti Sestieri 2009:19).

Overall, then, far from being absent from TCI, the BF is crucially important for understanding the emergence of large social collectives. Section 4.1 outlines the archaeological evidence from major spatial subsets. The available data for network reconstruction are scarce both in absolute terms and relative to the PF. As a result, these overviews do not include subset-specific networks. In section 4.2, I describe the full dataset and present and analyze the reconstructed network. Despite the many evidentiary problems associated with the BF, I note that relational patterns extracted from the aggregate network display encouraging regularities. As discussed in

chapter 7, in fact, they combine with those of the PF to suggest temporally and spatially coherent trajectories.

FIGURE 4.1 *BF-PF settlement patterns in northern TCI (filled circles represent sites that survive into the PF; the numbers indicate the major PF centers; 1. Veio, 2. Cerveteri, 3. Tarquinia, 4. Vulci, 5. Bisenzio, 6. Orvieto; adapted from Pacciarelli 2001:108, fig. 60).*



1. MAJOR SPATIAL SUBSETS

Alban Hills

Settlement evidence: Numerous BF settlements and burial grounds have been documented around the volcanic lakes in the interior of southern TCI. This area encompassed the highest feature in the region—the Mons Albanus (modern Monte Cavo), which at least in later periods served important ritual and political functions. Unfortunately, few settlements have been excavated and none fully published. The summit of Monte Cavo, for instance, seems to have hosted a sizeable BF village, but only select evidence from surveys and limited excavations carried out in the 1970s and early 1980s has been made available (Guidi, Pacciarelli, and di Gennaro 1978; di Gennaro and Guidi 2009a).

Funerary evidence: Data from the Alban Hills were foundational to the concept of a coherent ‘Latial culture’ with roots in the late BF (cf. Bettelli 1997). Several burial grounds were excavated more or less systematically in the late 19th and early 20th centuries (see Gierow 1964 for an overview). Additionally, recent work at Santa Palomba, just west of the core Alban Hills area, brought to light small grave clusters datable from the BF to the beginning of the sixth century (De Santis 2010a). Including BF data from Santa Palomba, 15 burials from this subset yielded suitable assemblages for network reconstruction.

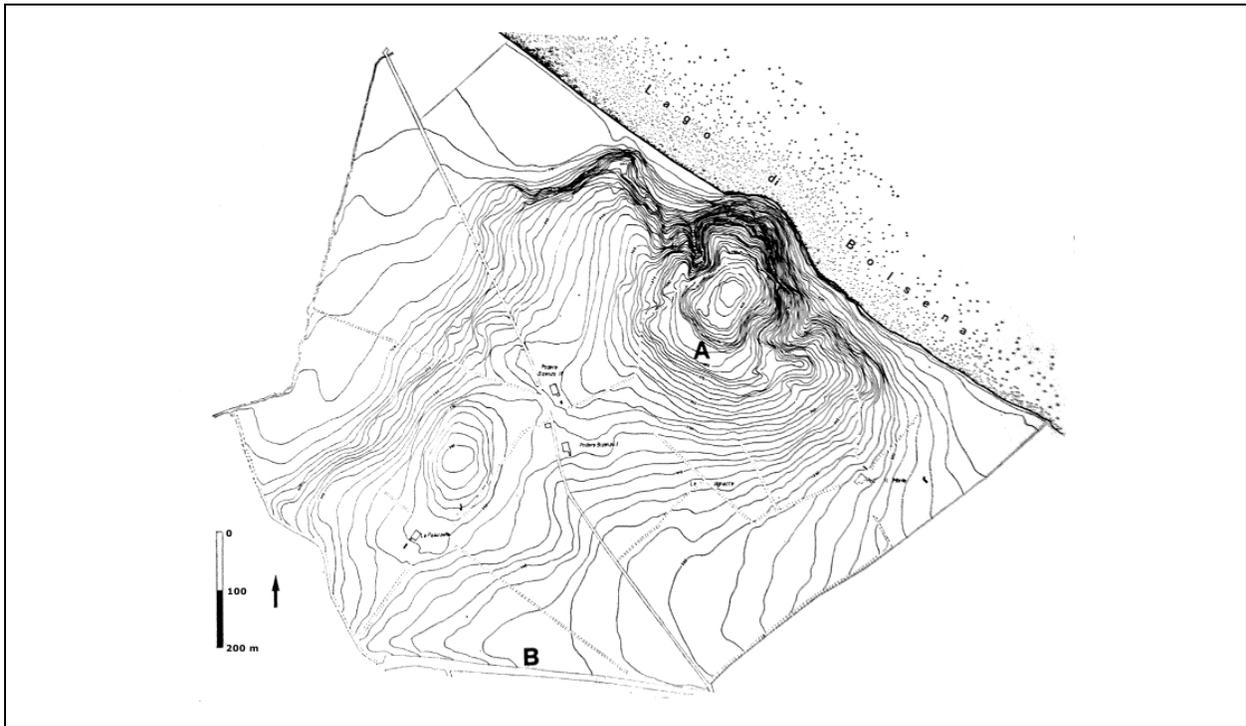
General observations: Between the end of the BF and the PF 2, the Alban Hills area seems to have lost much of its regional prominence. Although it was ideologically important in the historical period, as already mentioned, this subset did not see the emergence of ‘protourban’ settlements such as those attested along the coast and closer to the Tiber. This fact has been interpreted in connection with a shift in importance from the coast to the interior within northern TCI (Bietti Sestieri 1992:72-75). According to this model, which was introduced in section 3.3, during the BF and early PF 1 metal resources from the north were exchanged southward along the coast, and the Alban Hills served as an internal hub for their distribution inland. Then, around the time of the PF 1-PF 2 transition, the interior northern center of Veio rose in prominence, leading to substantial organizational changes within southern TCI. As nearby Rome became established as the starting point for both coastal and interior routes south of the Tiber, the area of the Alban Hills was relegated to a secondary role. Given the availability of suitable burial assemblages from this subset, in sections 4.2 and 7.3 it will be possible to evaluate whether the configuration of BF relations envisioned by this model is reflected in patterns of vernacular variability.

Bisenzio

Settlement evidence: Bisenzio and its immediate surroundings are known almost exclusively through survey (Raddatz 1975; Delpino 1977). The primary site is located on an elevated feature on the western shores of Lake Bolsena. The earliest secure evidence for habitation, which dates generally to the BF, may be connected to anthropic modifications of the natural topography geared toward improving defensibility (fig. 4.2, letter A; di Gennaro 1986:39; cf. the Castellina area of the Tarquinia plateau, discussed below). Small excavations carried out in the 1970s brought to light postholes and a large ceramic jar, known as a ‘dolium’, belonging to a single hut

(Delpino 1982). Limited or doubtful BF surface scatters have been documented in the immediate vicinity, but no other settlements can be securely identified.

FIGURE 4.2 *Topography of the site of Bisenzio (the northeastern limit corresponds to the shore of Lake Bolsena; letter A indicates a concentration of BF material, B a funerary area that has yielded possible BF material; adapted from di Gennaro 1986, table 6).*



The broader subset encompasses one of the best-documented BF settlements in the entire research area. Located approximately 30 kilometers northwest of Bisenzio, the site of Sorgenti della Nova is anchored to a defensible area of approximately five hectares on an elevated volcanic feature. Since the 1970s, systematic excavations have uncovered evidence for habitation, storage, and productive facilities in the form of huts and features excavated into the soft volcanic rock (e.g., Negrone Catacchio and Cardosa 2007). The inhabited area probably extended over a total of 15 hectares.

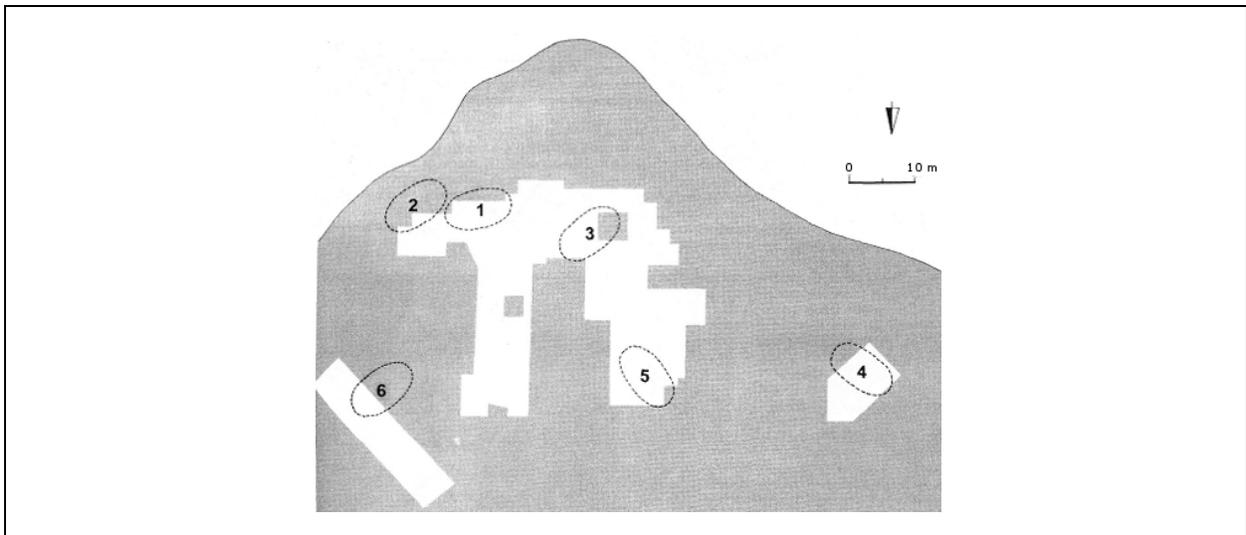
Funerary evidence: Sporadic, no suitable assemblages for network reconstruction.

General observations: However slim compared to more intensively investigated areas, the evidence for BF occupation at Bisenzio is interesting because it suggests a superficially different trajectory from other centers of northern TCI. In particular, the site's location on an elevated feature on the shores of a lake and pattern of growth and estimated extent during the PF find

better parallels in the south. As discussed further in chapters 5 and 7, therefore, Bisenzio is pivotal to the idea that superficially ‘anomalous’ developmental trajectories within TCI may be better understood in terms of the potential of local topographic features for confronting widespread dynamics of conflict and their effect on variables such as settlement density.

Sorgenti della Nova is also interesting in this regard, as it provides a good example of the relationship between the morphology of available topographic features and settlement density. Compared to sites characterized by larger defensible areas, Sorgenti della Nova features a much higher density of structures (Cardosa 2004:258-259). At nearby Sovana, for instance, where the elevated plateau covers some 16 hectares, extensive excavations have revealed few habitations (fig. 4.3).

FIGURE 4.3 Location of BF huts within excavated areas at Sovana (adapted from Cardosa 2004:283, fig. 2; cf. fig. 4.8).



These observations do not imply that the communities of the BF were passively caught at the intersection between currents of conflict and topography. Although these factors were probably determining, the relocating groups knew their landscape and to some degree were capable of modifying it and adapting the form of residential and other structures to suit their needs. As already mentioned, the geomorphology of the site of Bisenzio may have been modified to boost defensibility, and similar evidence has been documented at Tarquinia and other subsets. Landscape-amelioration efforts and planning are also attested at Sorgenti della Nova, with evidence ranging from the construction of artificial terraces to heterogeneity in the form of huts

and ancillary structures related to the morphological characteristics of different parts of the site (Cardosa 2004; Negroni Catacchio and Cardosa 2005).

Cerveteri

Settlement evidence: The major plateau of Cerveteri features limited scatters of BF settlement material. Additionally, survey in the surrounding territory has identified numerous possible settlements, but none has been excavated (cf. Barbaro 2010:18, fig. 1).

Funerary evidence: Only two burials have been documented in the area of the major plateau—one within the large PF cemetery of Sorbo and another from the nearby Poggio dell'Asino (Sorbo: Pohl 1972, burial 163; Poggio dell'Asino: Arancio and D'Erme 1991). The territory north of the plateau, however, close to the midway point to Tarquinia, encompasses several burial grounds. A majority were either badly damaged by illicit excavation or investigated unsystematically in the 19th and early 20th centuries. Fortunately, six sites are associated with suitable data for network reconstruction, yielding a total of 14 burials.

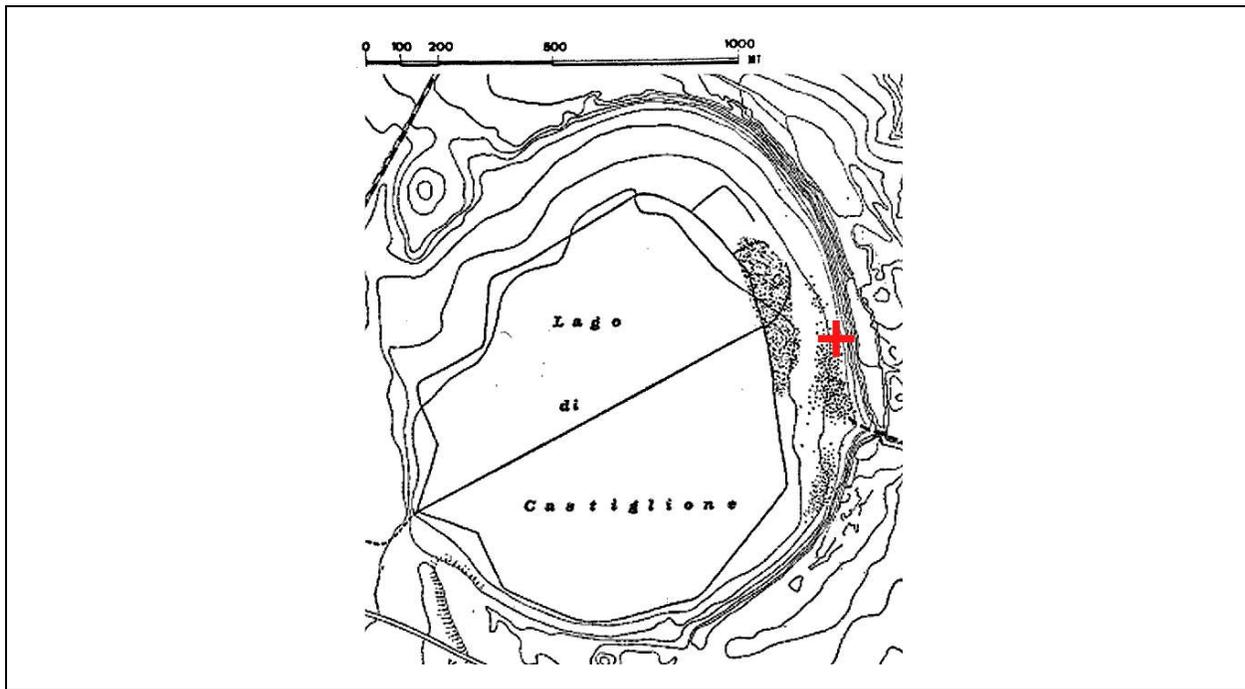
General observations: Both sporadic material and more or less intact burial assemblages suggest close stylistic parallels to funerary areas within southern TCI. The site of Montetosto Alto is illustrative. Surveys conducted beginning in the 1970s yielded thousands of urn fragments and other items consistent with BF funerary assemblages (data from recent survey efforts are presented in Barbaro 2010:274-302). Only four reasonably preserved graves have been excavated, but the surface fragments suggest that the burial ground encompassed at least 21 BF burials (for the excavated burials, all attributable to the BF 3, see Trucco, Mieli, and Vargiu 2000). On the whole, the material from this site includes high proportions of object types conventionally associated with southern TCI, including cinerary urns in the shape of huts and small jars with reticulated patterns ('ollette a rete'; Barbaro 2010:274).

Gabii

Settlement evidence: Gabii was occupied at least as early as the Middle Bronze Age. Possible traces of early activity areas surfaced from excavations on the eastern ridge of the Castiglione crater (fig. 4.4). Although the results of the work have not been fully published, preliminary reports indicate that only concentrations of pottery and faunal remains were uncovered, with no

direct evidence for dwellings (De Santis 2001a). The level of activity in the area seems to have diminished in subsequent periods down to the PF. No BF material is known from excavation and only limited proportions are attested within surface scatters.

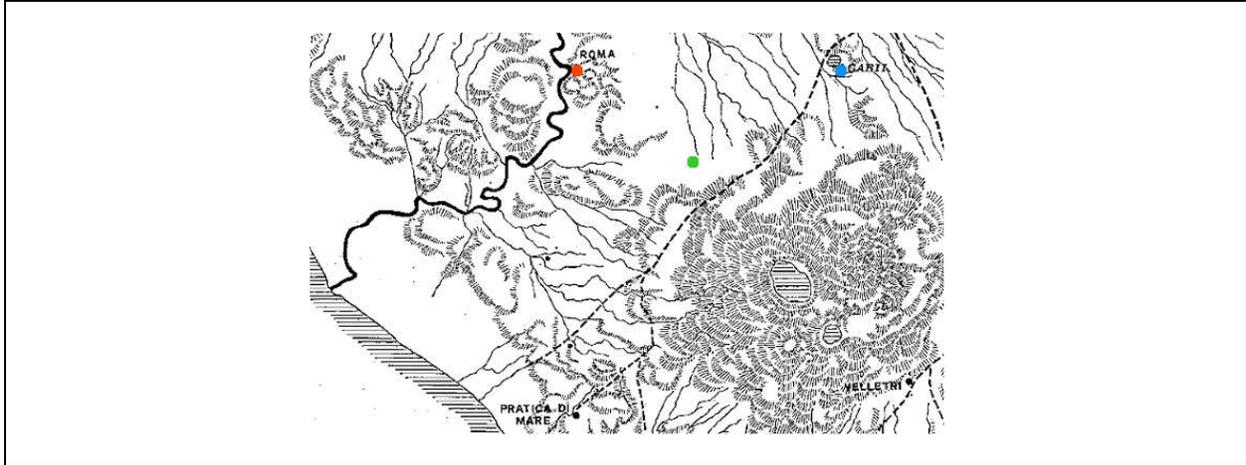
FIGURE 4.4 *Scatters of material datable between the Middle Bronze Age and the BF on the site of Gabii and location of excavations (dotted areas correspond to surface scatters; the location of the excavations is marked in red; adapted from Guaitoli 1981:29, fig. 3 and De Santis 2001:486, fig. 1).*



Funerary evidence: Although no burials have been identified in the immediate vicinity of the crater, one of the largest and best-documented concentrations of funerary evidence from southern TCI should perhaps be attributed to this subset. Some 20 burials from the BF 3 were excavated in 2001-2002 on either side of the via Lucrezia Romana (Quadraro site, fig. 4.5; di Gennaro et al. 2007). The settlement(s) with which these burials were associated has not been identified (the only nearby traces of non-funerary activity, which include probable stone embankments on either side of a palaeochannel, date to the BF 1-2 and earlier; di Gennaro et al. 2005). From a regional standpoint, the burial clusters in this area are located close to a hypothesized route linking the Apennines and Gabii to the coast (Guaitoli 1981). Although approximately equidistant from Gabii and Rome, therefore, within the aggregate network the Quadraro burials are characterized as part of the Gabii subset. It is important to note that this analytical choice is not meant to imply that there was any sort of formal organizational interdependence between the communities

associated with these burials and ones in the immediate vicinity of Gabii.

FIGURE 4.5 Location of the *Quadraro* burials relative to Gabii and Rome and hypothetical communication routes between the interior and coast (*Quadraro* in green, Gabii in blue, and Rome in orange; dashed black lines represent the communication routes; adapted from Guaitoli 1981:31, fig. 5).



Rome

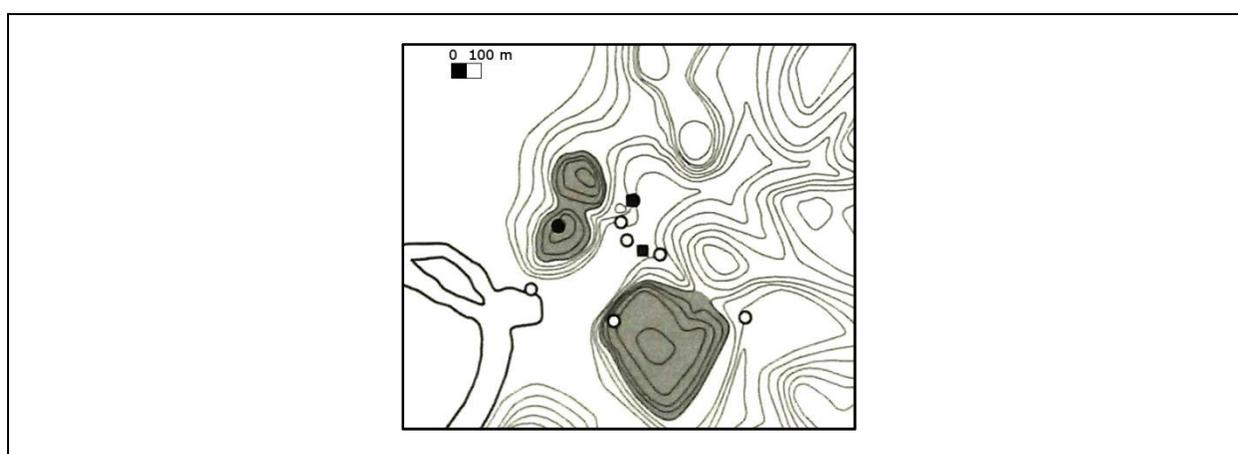
Settlement evidence: As attested by large quantities of material in secondary deposition, the site of Rome was occupied at least as early as Middle Bronze Age. More substantial evidence belongs to the subsequent period and the BF (especially on and around the Capitoline hill; fig. 4.6; e.g., Cazzella et al. 2007; Brock 2016). Excavations on the Capitoline have revealed traces of an extensive artificial terrace datable to the early horizons of the Late Bronze Age (Lugli and Rosa 2001). Continuity of activity on the Capitoline is attested by hearths and pottery fragments datable to the BF, as well as indications of further modification of the underlying topography (Boccuccia 2001). Additional evidence in primary deposition has been documented on the low ground between the hills. Notable features include postholes and parallel linear tracts cut into the bedrock, which have been interpreted respectively as pertaining to a hut and a road and can be dated stratigraphically to the early BF (De Santis et al. 2010b).

Funerary evidence: Burials datable between the end of the BF 3 and the beginning of the PF have been excavated in the area of the putative hut and road—the Forum of Caesar—and in the nearby Forum of Augustus (De Santis et al. 2010b; cf. De Santis 2001b). Altogether, 11 burials are associated with suitable assemblages for network reconstruction.

General observations: The construction of terraces on the Capitoline has been interpreted as

evidence for a high degree of organization and perhaps even the existence of a ‘ruling class’ (Cazzella 2001; Fulminante 2014:69). Even should the link between large construction projects and ingrained forms of communal organization be accepted, the archaeological evidence seems too slight to support such conclusions. In any case, Rome is not unique in this regard—as mentioned in the discussion of Bisenzio, several subsets feature evidence for large-scale modification of site morphologies.

FIGURE 4.6 *Findspots of BF settlement and funerary data and hypothetical extent of habitation areas at the site of Rome (squares denote funerary evidence, filled circles other material in primary deposition, open circles material in secondary deposition; shaded areas indicate the hypothetical extent of habitation; adapted from Alessandri 2013:389, fig. 192.28).*



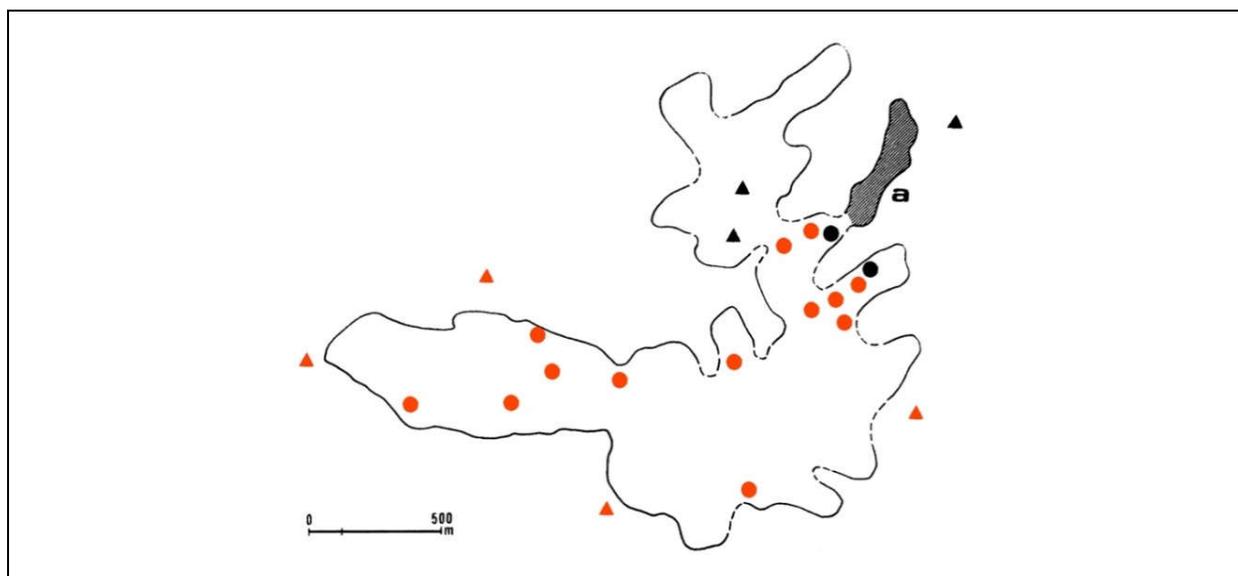
Tarquinius

Settlement evidence: Surveys and excavations on the major plateau and throughout the surrounding territory have yielded some of the best BF settlement evidence from the entire research area. The plateau appears to have been gradually occupied over the course of the period (fig. 4.7). Material datable to the early BF is limited to the northeastern sector, with the highest concentration on a feature of approximately three hectares that may have been artificially altered to improve defensibility (the ‘Castellina’, marked ‘a’ in fig. 4.7; for the possibility of anthropic modification, see Pacciarelli 2001:159-161; cf. the case of Bisenzio). Scatters pertaining to the end of the BF, on the other hand, are found across much of the plateau.

Excavations in the western sector of the plateau brought to light a so-called ‘Area Sacra’ in use beginning with the BF 3. The earliest features include the foundations of a small oval hut (2.8 x 2.2 m), patches of plaster flooring, and a clay-lined pit (Bonghi Jovino et al. 2010:163-165). The

identification of the area as ‘sacred’ stems from the presence of a natural cavity in the bedrock that appears to have been cleaned periodically, pits containing possible votive material, traces of hearths, and the presence of purported faunal and botanical offerings (e.g., deer antlers, some partially worked, which were tentatively interpreted as pertaining to the cult of the historically documented goddess Artumes; Bonghi Jovino 2005:78).

FIGURE 4.7 *BF material on the Civita plateau, Tarquinia (triangles indicate funerary areas, circles miscellaneous pottery; BF 1-3 in black, BF 3 only in orange; the letter ‘a’ denotes the Castellina; adapted from Mandolesi 1999:135, fig. 62).*

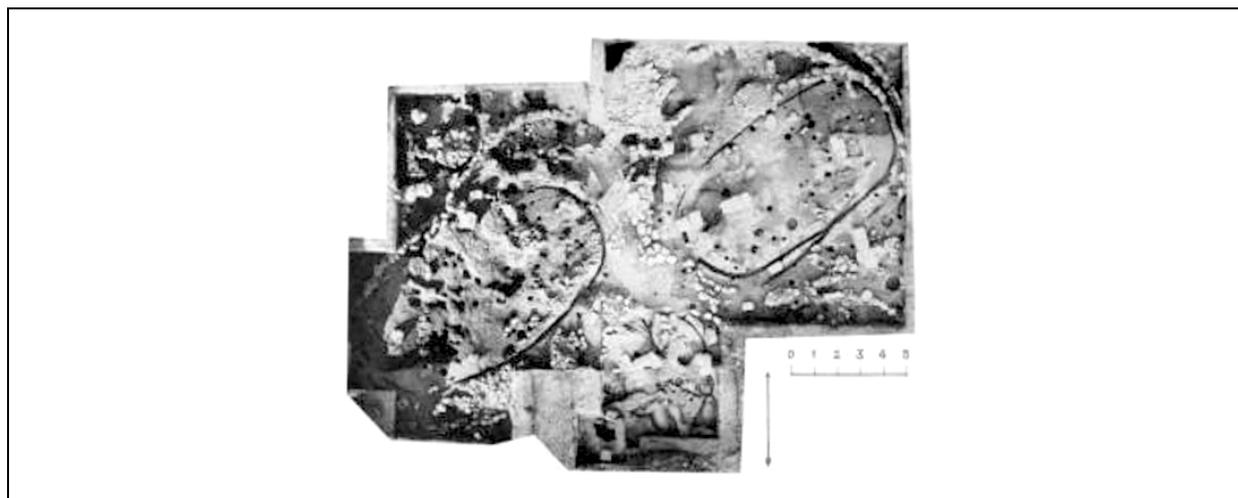


Numerous surface scatters as well as excavated sequences document intensive BF occupation in the territory surrounding the plateau. The settlements of Luni sul Mignone, Monte Rovello, and San Giovenale, all located close to the Mignone River south of Tarquinia, provide clear examples of settlement continuity from earlier phases of the Bronze Age (e.g., di Gennaro 2004). Additionally, evidence for early fortifications and artificial terraces has been uncovered at sites such as Elceto-Pian del Pero (Toti 1972), Ferleta (Mandolesi 1999:161-162), and Monte Rovello (Toti 1976).

The site of San Giovenale has been studied systematically. A defensible area of approximately three hectares was strengthened with artificial fortifications already in the 13th-12th centuries, and excavations around this area of the site have documented a steady increase in activity during the BF (e.g., Barbaro et al. 2012:200). Features attributable to this phase include two oval huts comparable in dimensions and plan to those documented at Sovana and just slightly smaller than

formally similar huts at Sorgenti della Nova (fig. 4.8; cf. fig. 4.3 for the Sovana huts). Unfortunately, the evidence from San Giovenale is too fragmentary to extend the discussion of relative settlement densities based on those sites.

FIGURE 4.8 *Foundations of BF huts at San Giovenale (area D, huts 1 and 2; scale in meters; adapted from Malcus 1984, fig. 20).*



Funerary evidence: The southern portion of the subset features a large number of burial grounds. In addition to badly damaged contexts and sporadic finds similar to those attested in the northern sector of the Cerveteri subset, this area includes the largest BF funerary area from TCI—Poggio della Pozza, which was probably associated with the settlement of Monte Rovello (located approximately 600 meters to the north; Barbaro 2010:131-132). The burial ground was already known and partially excavated in the late 19th and early 20th centuries (e.g., Colini 1911). Such work revealed at least 39 burials, most of which were only partially documented. Fortunately, excavations in 1960 and the early 1990s produced more reliable data (Peroni 1961; D’Ercole 1995 and 1998). Based on the density of interments within recently excavated areas and the extent of surfaces investigated during earlier efforts, it has been hypothesized that the cemetery could have encompassed well over 100 graves (e.g., D’Ercole 1995:179). Including those from Poggio della Pozza, a total of 23 burials from this subset included suitable objects and were published in sufficient detail to support network reconstruction.

General observations: The features associated with the ‘Area Sacra’ in the western sector of the Civita plateau seem consistent with productive activities. Monumental structures and deposits datable to the seventh and sixth centuries can be linked more persuasively to ritual activity

focused on the bedrock cavity (cf. section 6.1), but it seems problematic to allow this much later evidence to color the interpretation of the BF data. With regard to the funerary evidence, systematic analyses of variability in the structure of the graves and assemblage composition have highlighted parallels with the cluster of funerary sites in the northern portion of the Cerveteri subset (e.g., Pacciarelli 2001:202-211). Because these two areas encompass the near totality of BF funerary evidence from northern TCI, it is difficult to determine the extent to which such affinities reflect spatial proximity or a widespread phenomenon of dense connectivity such as might be inferred from the more regular distribution of BF settlement evidence compared to the PF (cf. fig. 4.1).

Veio

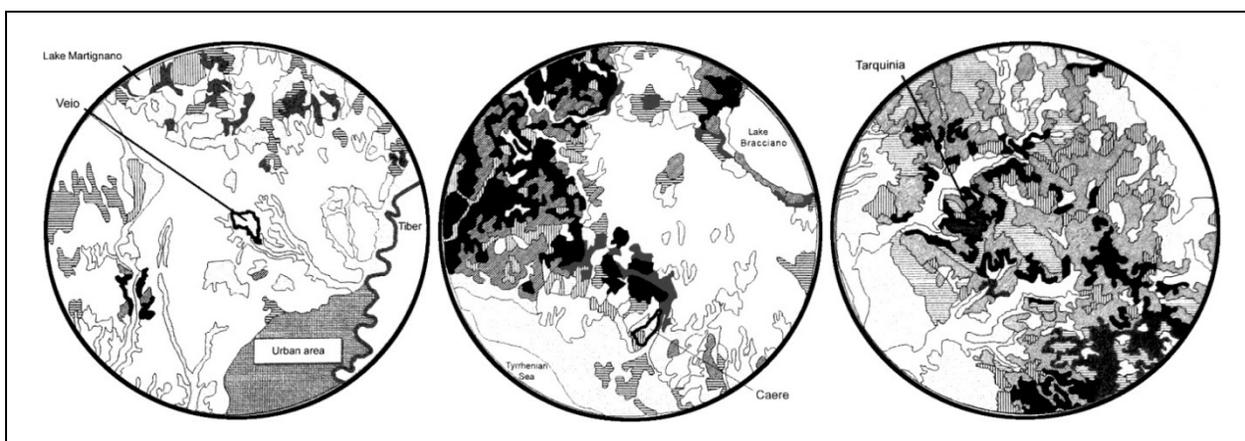
Settlement evidence: Aside from defensive works datable to the very end of the period, the major plateau has yielded little evidence for BF occupation (for the defensive works, see Bartoloni et al. 2013:137-138). Much like in the case of Tarquinia, early in the period habitation may have been confined to peripheral areas or partially separate features (cf. Pacciarelli 2001:159). For example, traces of possible huts have been uncovered at Isola Farnese, a small defensible area separated from the southwestern portion of the plateau by a water course (Babbi 2005; Bartoloni 2012). Otherwise, despite intensive surface investigation (reviewed in Cascino, Di Giuseppe, and Patterson 2012), the territory within a 10-kilometer radius of the plateau appears devoid of BF settlements.

Approximately 40 kilometers to the north, the site of Monte Cimino has yielded some of the best evidence for BF fortifications from the research area (Barbaro et al. 2011). The site may have been occupied in the Middle Bronze Age or earlier, though the majority of the excavated material dates to the BF. Recent work has uncovered tracts of dry stone walls enclosing an area of approximately five hectares. A slightly higher area of less than one hectare within this perimeter may have been further fortified. It is interesting to note that the defensive structures around the outer limit of the settlement appear to have been destroyed by fire and covered by leveling layers at least twice between the BF 1-2 and early BF 3 (Barbaro et al. 2011:616-617). The ongoing work at Monte Cimino is thus providing not only an unusually detailed glimpse of an articulated system of defensive works but perhaps also direct evidence for the frequency of conflict during this crucial stage in the transition to large social collectives.

Funerary evidence: Sporadic, only one suitable assemblage for network reconstruction (Casale del Fosso 838; Pacciarelli 2001:161, fig. 98).

General observations: Given that significant effort has been expended to document late-prehistoric activity in the territory of Veio, the scarcity of BF remains has been interpreted as evidence for a different trajectory compared to other northern subsets: “the foundation of the vast settlement of Veio may be explained as a phenomenon of imitation or external induction. It was therefore a subsequent development [compared to Tarquinia and Vulci], which cannot have had identical causes despite belonging to the broader process of the formation of large sociopolitical entities that characterizes the region” (di Gennaro and Guidi 2009b:435, my translation).⁹ Few contributions attempt to account systematically for the factors that could have engendered such a different trajectory. Based on soil-quality surveys carried out in the late 1970s, however, it has been suggested that Veio’s growth may have been tied to the abundance of prime agricultural land around the plateau (Schiappelli 2012:330-334). Compared to Tarquinia and Cerveteri, a much higher percentage of soils within a 12.5-kilometer radius of Veio was classified in the top two out of seven classes of agricultural potential according to factors such as depth, matrix, texture, and permeability (fig. 4.9; Veio: close to 90 percent; Cerveteri: 60-70 percent; Tarquinia: close to 40 percent).

FIGURE 4.9 *Agricultural potential of soils within 12.5-kilometer radii of Veio, Cerveteri, and Tarquinia (from left to right; gray and black areas correspond to poor-quality soils; adapted from Schiappella 2012:332, fig. 6.3; data originally from Romano, Macella, and Scandella 1979).*



⁹ “La formazione del centro protourbano di Veio è quindi successiva a quella di Vulci e Tarquinia [...]; la fondazione del vasto abitato veiente si può spiegare come un fenomeno di imitazione o di induzione da parte di realtà esterne. Si tratta dunque di un avvenimento successivo, che non può avere identiche ragioni pur nell’ambito di uno stesso fenomeno di formazione di vaste entità sociopolitiche che caratterizza la regione”

2. BASE FOR RELATIONAL RECONSTRUCTION

Out of all published BF burials from TCI, 95 are associated with assemblages containing one or more clay objects (note that, as discussed in chapter 2, urns, urn covers, and other containers directly related to the disposal mode are not considered). All but four date to the end of the period. Although the BF 3 is better documented than the BF 1-2 across most categories of archaeological evidence, several dozen early burials are known from throughout the research area (e.g., at least 28 from southern TCI; see Bietti Sestieri 2009:19). The scarcity of BF 1-2 assemblages containing clay objects is thus striking.

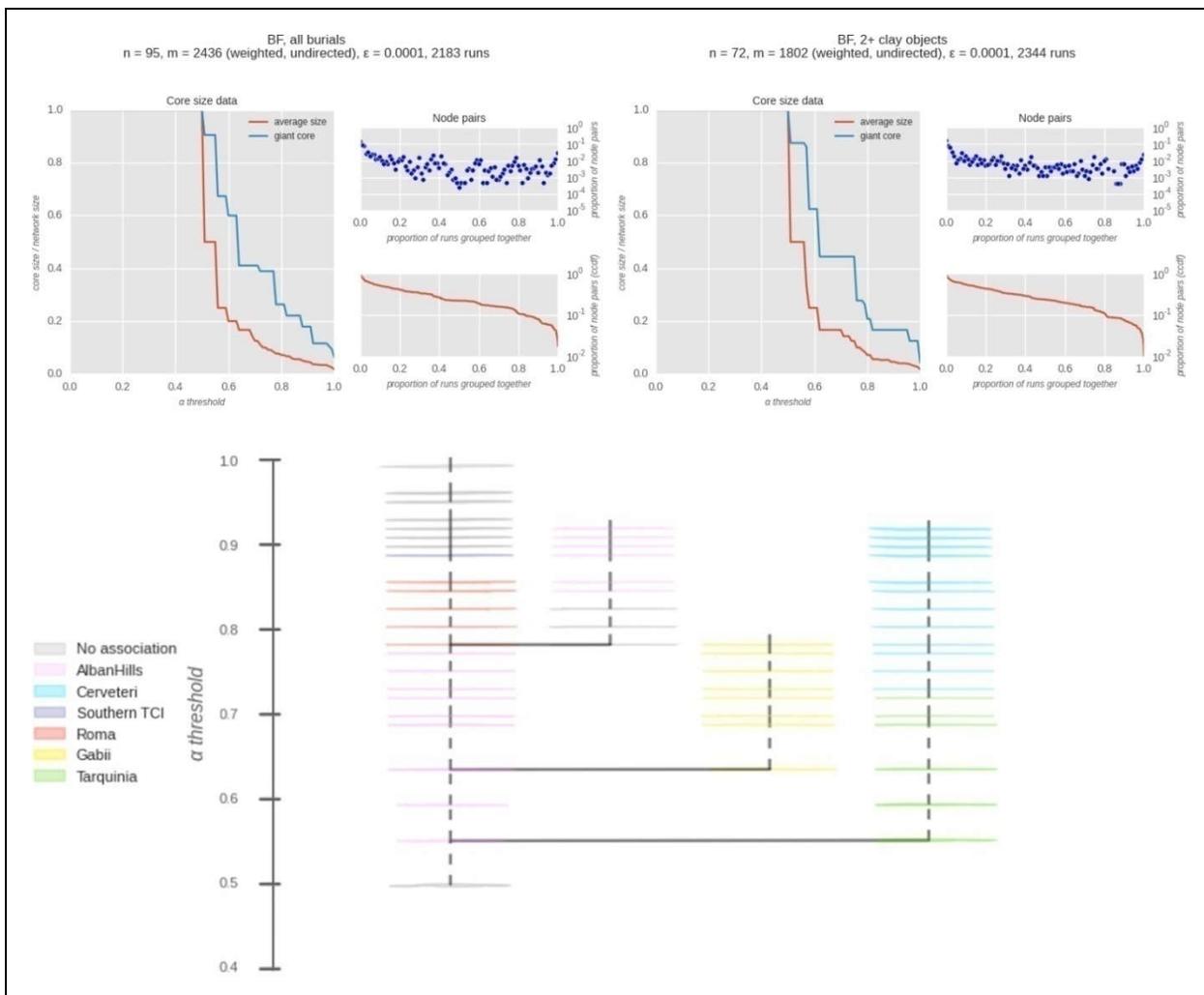
This aspect of the record could reflect changes in mortuary practices (e.g., De Angelis 2006:582)—early BF burials may have included fewer or no vessels or ones made of perishable materials. Even so, postdepositional disturbances and/or poor documentation are almost certainly part of the issue. Many burial grounds were heavily damaged by later phases of activity, modern agricultural work, and looting. In the case of early excavations, moreover, such as those in the Alban Hills region of southern TCI and the Tolfa-Allumiere area in the north, it is possible that clay objects were not systematically recorded or even recognized as pertaining to the assemblages of individual burials. The reports associated with such work tend to describe pottery summarily or dismiss it altogether (e.g., Klitsche de la Grange 1884:152). These factors also impact the BF 3 sample, of course, but at least with regard to the problem of documentation it is worth noting that a higher proportion of BF 1-2 burials were unearthed in the course of early excavations.

Regardless of chronology, assemblages that include one or more clay objects could also be incomplete. As discussed in the following chapters, data on the state of preservation of individual burials from the cemeteries of Osteria dell'Osa and Quattro Fontanili and patterns of structural plausibility observed in subset-specific networks suggest that PF burials containing fewer than two clay objects are better excluded from the aggregate networks. Approximately three quarters of BF assemblages contain two or more objects (72 out of 95). A network consisting only of such burials arguably displays better structural patterns than one based on the entire sample (fig. 4.10; cf. the presentation of expected structural patterns in section 2.3). The difference is not dramatic, however, and as discussed below the two networks yield comparable summary measures. Accordingly, in the absence of corroborating evidence from systematic excavations and subset-

specific networks, it seems preferable to proceed with the network based on the entire sample.

The first major branching event in the aggregate network based on all burials occurs at a threshold of 0.56 (see dendrogram in fig. 4.10). This split distinguishes roughly half of the burials from Tarquinia and Cerveteri from the bulk of the Alban Hills, Gabii, and Rome subsets (Tarquinia: 12 out of 23 burials, with a residual of 3.992; Cerveteri: 7 out of 14 burials, residual of 2.724). As the resulting branch develops, it sheds loosely connected burials from Tarquinia at a relatively high rate, so that by a threshold of 0.73 the cores are more strongly associated with Cerveteri. The objects at the root of this branching event are small spouted vessels ('askoi'; residuals of 6.036 for single instances and 4.349 for pairs).

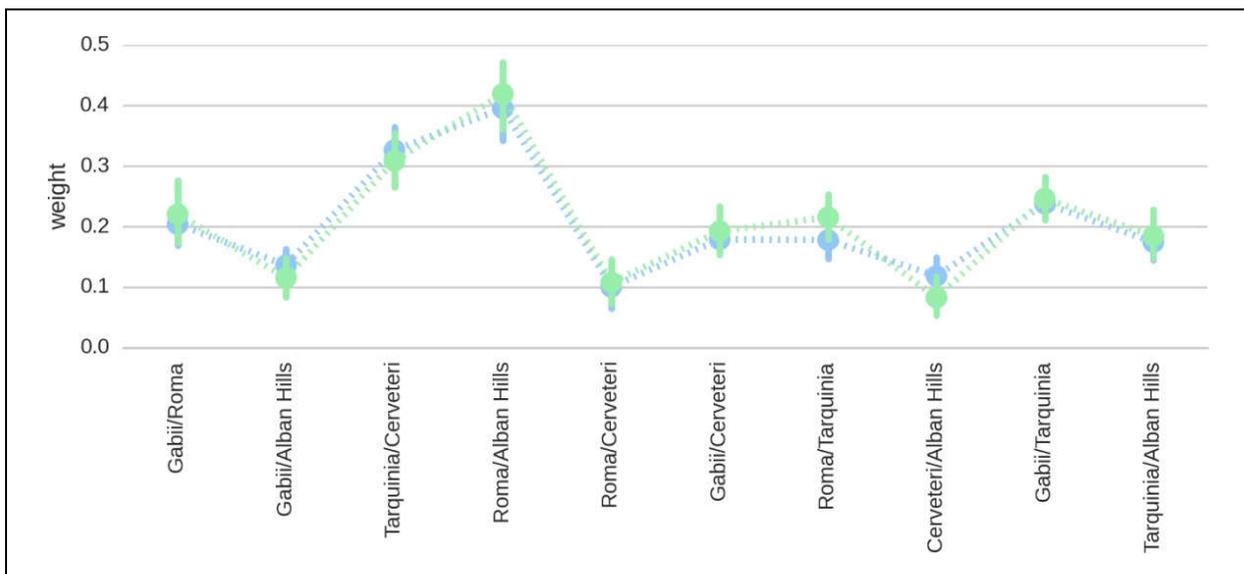
FIGURE 4.10 *BF aggregate networks (top left: all burials; top right: burials associated with two or more clay objects; bottom: all burials, major branching events and core-spatial subset statistical associations; color opacity corresponds to the magnitude of adjusted residuals, with gray indicating values between zero and two; 'Southern TCI' collects sporadic burials from multiple southern TCI contexts).*



At a threshold of 0.64, the second offshoot of the main branch isolates just over half of the burials from the Gabii subset (11 out of 19 burials, residual of 4.630). These burials are characterized by the presence of single instances of bowls with articulated profiles ('ciotole', residual of 7.572), which in many cases occur together with simpler conical forms ('scodelle', residual of 6.153). Variations in the residuals demonstrate that core membership continues to change beyond this level, and in fact a final split occurs at a threshold of 0.78. Due both to their heterogeneous composition and diminishing size, however, the cores that make up the main branch and its offshoots above 0.64 cannot be reliably connected to any particular spatial subset.

In light of the diversity of the main branch of the network and diffuse spatial distribution of the evidence, it might be expected that p_{ij} averages for subset-versus-subset comparisons should be relatively homogeneous, but this is far from the case (fig. 4.11; normalized values are listed in table 4.1 at the end of the chapter). In particular, the Tarquinia/Cerveteri and Rome/Alban Hills averages are far above the norm. These affinities conform to observations based on traditionally emphasized categories of evidence. Strong ties have long been reconstructed between the areas of Tolfa and Allumiere, which encompass most of the evidence from Tarquinia and Cerveteri, and an alternate designation for the BF 3 within southern TCI is the 'Roma-Colli Albani/Rome-Alban Hills' horizon (cf. the nuanced exposition in Peroni 1996:340-347).

FIGURE 4.11 *Averages of subset-vs.-subset p_{ij} distributions for the BF (ordered by spatial distance; blue: all burials; green: burials containing two or more clay objects; the dashed lines are provided to facilitate comparison and underscore the presence of both data points when they take similar values; vertical bars indicate 95 percent bootstrap confidence intervals for each average).*



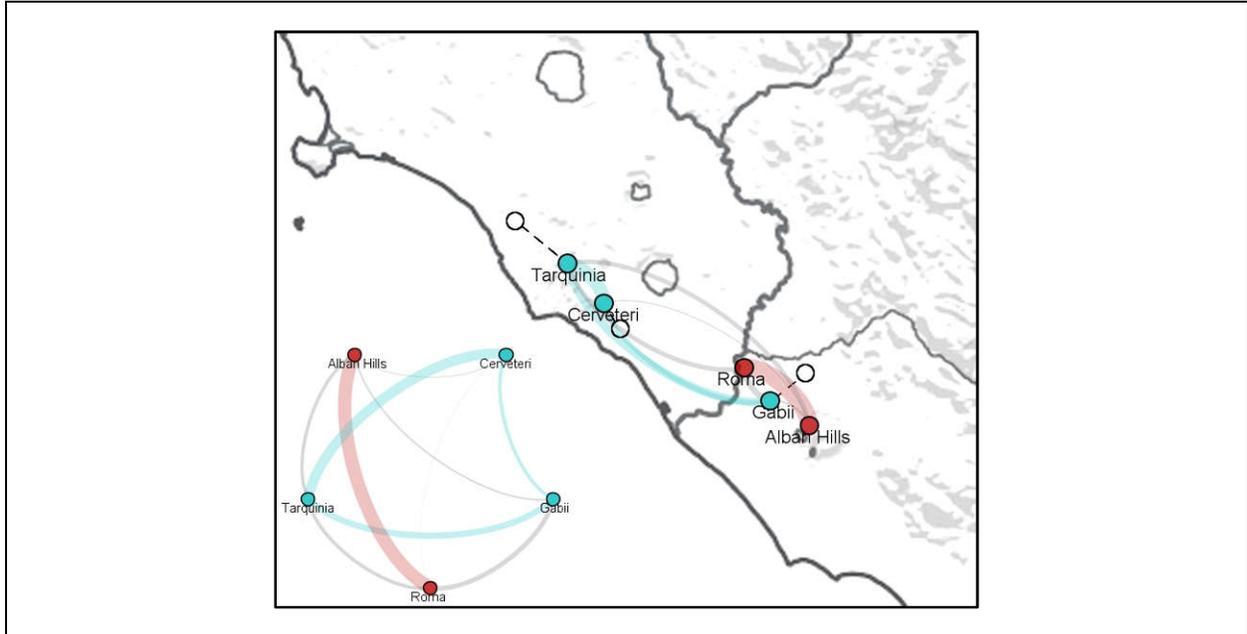
More striking are the averages for comparisons involving the Gabii subset. As explained in the preceding section and illustrated in figure 4.5, recent excavations uncovered a relatively large number of BF burials within funerary areas located almost exactly between the core of the Alban Hills, the site of Gabii, and Rome. Because these burials are situated very close to a natural route between the coast, Gabii, and on to the Apennines, I tentatively attributed them to the Gabii subset. As it turns out, the Gabii/Alban Hills and Gabii/Rome averages are lower than the one between the Alban Hills and Rome. Extending the scope of the analysis beyond this area, the Gabii subset appears closely connected to the coast of northern TCI. Despite the much greater spatial distances involved, the averages for Gabii/Cerveteri and Gabii/Tarquinoa are comparable to or greater than those for Gabii/Rome and Gabii/Alban Hills.

Anchoring a network derived from the relational averages on a map of TCI helps account for these patterns. Before proceeding, however, it is important to note the similarity between the averages obtained by considering all burials versus only those associated with two or more objects, both of which are illustrated in figure 4.11. Applying the clay-object threshold primarily impacts the Alban Hills, Gabii, and Tarquinia subsets, which in combination account for 19 out of 23 excluded burials—close to half of the Gabii sample and between a third and a fourth of those for the Alban Hills and Tarquinia are removed. The averages for comparisons involving Gabii are essentially unaffected, while in the case of the Alban Hills and Tarquinia only one comparison results in a difference of more than a few percentage points. Given the host of biases that could affect the composition of published assemblages, the basic comparability of outcomes from the two aggregate networks is reassuring.

When plotted on a map, the normalized averages take the form of a densely connected network, with a few strong ties superimposed on a low-intensity relational background (fig. 4.12). Correcting for relational ‘noise’ may thus alter the picture (section 7.3), but taken at face value the relatively high averages between Cerveteri, Gabii, and Tarquinia suggest the possibility of a north-south coastal circuit connected to the interior of southern TCI through the general area of Gabii. If spatial distances are adjusted for the convenience of coastal or maritime travel and the likely coast-Gabii-Apennines route illustrated in figure 4.5, it is easy to envision that in practice the Gabii subset might have been relatively ‘close’ to Tarquinia and Cerveteri. The Alban Hills and Rome were not disconnected from this circuit, but their participation was probably less

direct.

FIGURE 4.12 *BF relational patterns derived from average p_{ij} values (edge thickness corresponds to the normalized values listed in table 4.1; node and edge colors reflect topological communities, with inter-community edges in grey; the empty circles connected to the Cerveteri, Gabii, and Tarquinia nodes indicate the location of the associated PF centers; circular layout provided on the bottom left for reference).*



Section 3.3 and the overview of the evidence from the Alban Hills area in section 4.1 introduced a prominent model that attributes the formation of ‘protourban’ centers within southern TCI to shifting patterns of interregional exchange between the BF and PF 2. By the late BF, the primary axis of communication would have extended from Tarquinia and Cerveteri to coastal settlements across the Tiber, with an inland extension centered on the Alban Hills. Around the late ninth and early eighth centuries, however, Veio’s supposed rise in prominence would have “released the potential for long-distance communication and territorial control which was inherent in the geographic situation of Rome”, and this shift in turn would have engendered “the decline of the Alban Hills as the natural centre of intra-regional communication from the coast to the interior” (Bietti Sestieri 1992:72-73). As noted in chapter 3, this model is far from the only one to attribute developments in the south more or less directly to diffusion, though it is the most clearly articulated.

The relational patterns presented in this section seem to corroborate the importance of interaction between the northern coastal subsets and southern TCI, but the Alban Hills area does not appear

as the sort of hub hypothesized by the model. It might be objected that the sample for the aggregate network is too small for the results to be compared to traditional reconstructions of BF interaction patterns, which also invoke other lines of evidence. In my view, however, relational averages derived from hundreds of systematic burial-to-burial comparisons—from a minimum of 154 for Rome/Cerveteri to 460 for Gabii/Tarquinoa—cannot be dismissed lightly. In any case, the resulting patterns do not deviate so drastically from traditional reconstructions as to be rejected outright. Instead, they suggest that dynamics of interaction were almost certainly more complex than previously thought. This fortunate outcome of partial correspondence also emerges from the discussion of PF patterns presented in sections 5.2 and 6.2. Just as important, as argued in section 7.3, the BF and PF averages combine to suggest plausible developmental trajectories across the research area.

TABLE 4.1 *Spatial distances and subset-vs.-subset p_{ij} averages for the BF (sorted by p_{ij} averages; values normalized to ease comparison between spatial and relational distances).*

<i>Subsets</i>	<i>Spatial distance</i>	<i>Average p_{ij}</i>
Roma/Cerveteri	0.451931	0
Cerveteri/Alban Hills	0.792299	0.060376
Gabii/Alban Hills	0.018032	0.121386
Tarquinia/Alban Hills	1	0.249937
Roma/Tarquinia	0.654439	0.261976
Gabii/Cerveteri	0.60567	0.265509
Gabii/Roma	0	0.350983
Gabii/Tarquinia	0.813433	0.465699
Tarquinia/Cerveteri	0.046991	0.765465
Roma/Alban Hills	0.181301	1

CHAPTER 5: EARLY IRON AGE 1 (PF 1)

The onset of the PF is associated with watershed changes in the absolute quantity and spatial and chronological distribution of funerary data within TCI. In place of the small burial clusters of the BF, cemeteries consisting of hundreds or even thousands of interments developed around major settlements. Since the late 19th century, excavations at these sites have yielded substantial samples of burials, but this record is far from unproblematic. Most cemeteries were severely disturbed through centuries of pilfering, urban development, and agricultural intensification. Even the earliest excavation reports stress that large proportions of burials appeared incomplete (select reports are cited in section 5.1). Human remains were not always collected, and occasionally they were lost and assemblages from different burials mixed in subsequent decades. As a result, field notes and sketches constitute the only sources of information for many cemeteries. With few exceptions, the unsystematic nature of such documentation means that only a fraction of excavated burials can be studied in detail. Data from recent excavations for the most part have corroborated patterns inferred from these sources. Due in part to limited funding for conservation and analysis, however, publication times tend to run into the order of decades.

Nevertheless, large PF datasets can be derived from throughout TCI (table 5.1), so that it is often possible to examine the structural plausibility of network representations for individual subsets or even individual burial grounds. In section 5.1, in addition to providing general outlines of the evidence, I discuss such representations and their implications for the reconstruction of the PF 1 aggregate network. In the process, I note that filtering samples by the number of clay objects included in assemblages greatly affects structural plausibility. As detailed in the discussion of the Cerveteri subset, moreover, at Osteria dell'Osa and Quattro Fontanili—the only two cemeteries for which degree of preservation was recorded and published systematically—assemblages with fewer than two clay objects are significantly associated with evidence for post-depositional disturbances. Accordingly, I adopt a two-object cutoff to derive the sample for the aggregate network, though I acknowledge that some of the excluded burials could actually have

been well preserved and recorded.

TABLE 5.1 *PF sample characteristics for all subsets of TCI associated with at least 20 burials (clay objects only).*

<i>Spatial subset</i>	<i>Total burials</i>	<i>Cremations</i>	<i>Inhumations</i>	<i>Total objects</i>	<i>% burials with 2+ objects</i>	<i>Average number of objects</i>		
						<i>all burials</i>	<i>crem.</i>	<i>inh.</i>
Bisenzio	68	68	0	550	1.00	8.09	8.09	N/A
Cerveteri	128	66	62	238	0.37	1.86	1.70	2.03
Gabii	490	36	454	2197	0.93	4.48	6.25	4.34
Roma	99	20	79	396	0.89	4.00	6.90	3.23
Tarquinoa	245	232	13	660	0.60	2.69	2.69	2.85
Veio	335	86	249	1316	0.72	3.93	3.69	4.01

In section 5.2 I present and analyze the aggregate network, which in addition to the samples discussed in section 5.1 includes sporadic burials and data from contexts not clearly linked to any of the newly formed centers. A major issue associated with this network is the impact of disposal mode on vernacular variability. While cremation and inhumation dominate the BF and PF 2 samples, respectively, in the PF 1 both ritual types are present in different proportions within almost all cemeteries. In terms of broad chronological trends, moreover, within northern subsets inhumations tend to be confined to the end of the period. Statistical patterns in the composition of cores suggest that the cremation/inhumation divide conditions the structure of the network at high thresholds. As a result, I compute summary relational measures separately for cremations and inhumations. I conclude the chapter by illustrating the resulting patterns and outlining their evidentiary potential. In light of the uneven chronological distribution of cremations and inhumations within the sample, I suggest that the cremation network may represent a slightly earlier horizon of the PF 1.

1. MAJOR SPATIAL SUBSETS

Bisenzio

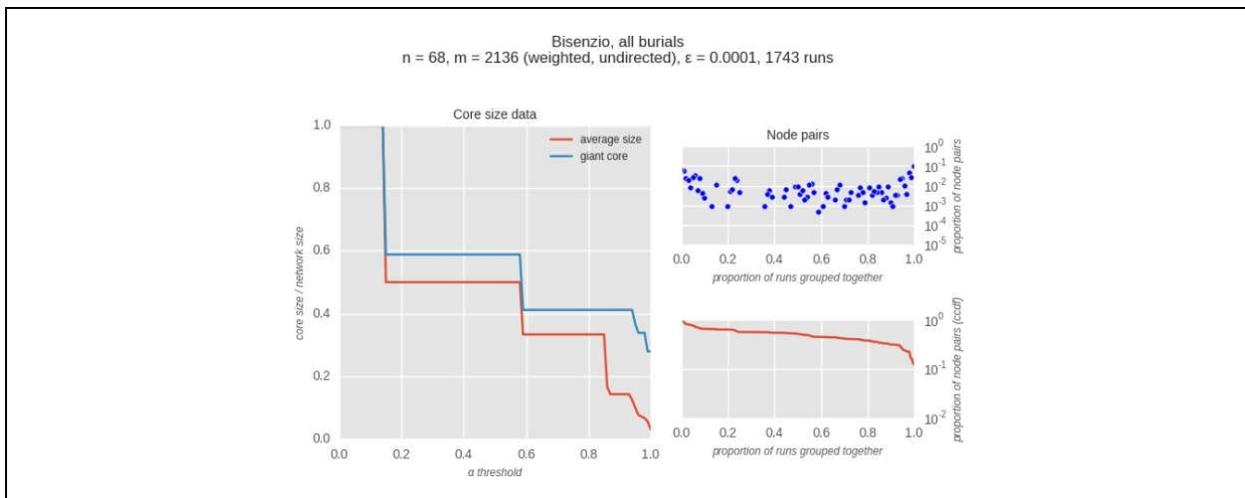
Settlement evidence: Surface scatters suggest that the settlement on the shores of Lake Bolsena expanded significantly from the promontory occupied during the BF to the surrounding low ground, though the lack of excavation data makes it difficult to estimate its full extent. Estimates range from 35 to 85 hectares or more (cf. section 7.4; 35 ha.: di Gennaro 1986:142; 85 ha.:

Pacciarelli 1994:236-237). Other settlements discussed in the BF overview are no longer attested.

Funerary evidence: Several burial grounds were partially documented around the major settlement in the late 19th and early 20th centuries. The bulk of suitable data for network reconstruction comes from cemeteries on the southwestern side of the promontory—Piana S. Bernardino, Polledrara, and Porto Madonna. The chronology of these contexts is difficult to pin down, but they likely belong to the final stages of the PF 1 or the very beginning of the PF 2 (Iaia 1999:93-94). The resulting sample comprises 68 burials, all cremations. Unfortunately, no independent determinations of sex and age are available, and data on the spatial organization of the cemeteries are scarce.

The Bisenzio sample stands out for the absence of inhumations and high average number of clay objects (table 5.1). Although the inclusion of a large number of clay objects in assemblages may be a distinguishing feature of mortuary vernaculars in this area, the figures in table 5.1 could also indicate that the Bisenzio burials were relatively undisturbed and well recorded. A network representation of the entire sample is characterized by fairly coherent structural patterns (fig. 5.1; cf. the presentation of expected structural patterns in section 2.3).

FIGURE 5.1 *Network based on the PF 1 sample from the Piana S. Bernardino, Polledrara, and Porto Madonna cemeteries, Bisenzio.*



General observations: Bisenzio is often cited as a case study contrasting other subsets of northern TCI (e.g., Pacciarelli 2009:393). For one thing, the BF-PF transition in this area seems to have

involved the agglomeration of population around a preexisting settlement on a high promontory, whereas other northern subsets saw the occupation of extensive but still easily defensible volcanic plateaus. Burials from this area, moreover, tend not to conform to the canonical ‘Villanovan’ attributes exemplified most clearly at Tarquinia, which is considered a cultural epicenter of sorts (e.g., Iaia and Pacciarelli 2012). They feature unusual ceramic types as urns, for instance, and include more complex combinations of pots, while elements of the ritual such as widespread use of miniaturization recall BF practices and parallel their partial continuation within southern TCI (Delpino 1977; Iaia 1999:125-126; Iaia and Pacciarelli 2012:353-354). As a result, for a long time Bisenzio was not considered representative of the PF ‘protourban’ phenomenon. Beginning with the wave of syntheses of the TCI evidence published in the 1980s, however, it has been treated as a primary center in its own right, however idiosyncratic (di Gennaro 1986:142; Pacciarelli 1991:171-172; recently, Bietti Sestieri 2010:254-255).

Cerveteri

Settlement evidence: PF 1 Cerveteri and its territory are known primarily through survey (Cristofani, Nardi, and Rizzo 1988; Maffei and Nastasi 1990; Cerasuolo 2008). As in other parts of northern TCI, such evidence suggests major organizational changes. Most BF sites are no longer attested, though the coastal area appears to have been settled or at least utilized for productive activities more intensively than in other phases (e.g., Pacciarelli 1991:169-170). According to conventional reconstructions, population converged on the site of the historical city of Caere. Scatters of material from this period occupy discontinuously much of the observable extent of the plateau, which at 160 hectares ranks among the largest in northern TCI (fig. 5.2).

Funerary evidence: The only extensively documented cemetery, Sorbo, lies just southwest of the plateau (Vighi 1955; Pohl 1972). Some 450 burials were excavated in the early 20th century, of which close to half can be placed in the PF 1. In part due the early date of the excavation, the available documentation leaves much to be desired. Bioarchaeological determinations of sex and age are lacking, and even the internal chronological articulation of the cemetery is difficult to pin down beyond the level of broad phases. The only systematic attempt to parse the sample chronologically relied on a problematic classificatory approach for ‘impasto’ coarse wares (Pohl 1972; classificatory scheme described in Gierow 1961; Gjerstad 1966; for an early refutation, see

Peroni 1962). As a result, this important cemetery has been excluded from most attempts to correlate chronologies across TCI.

FIGURE 5.2 *PF scatters on the site of the historical city of Caere (adapted from Pacciarelli 1991:187, fig. 8b; scale in meters; lined area represents modern habitation).*

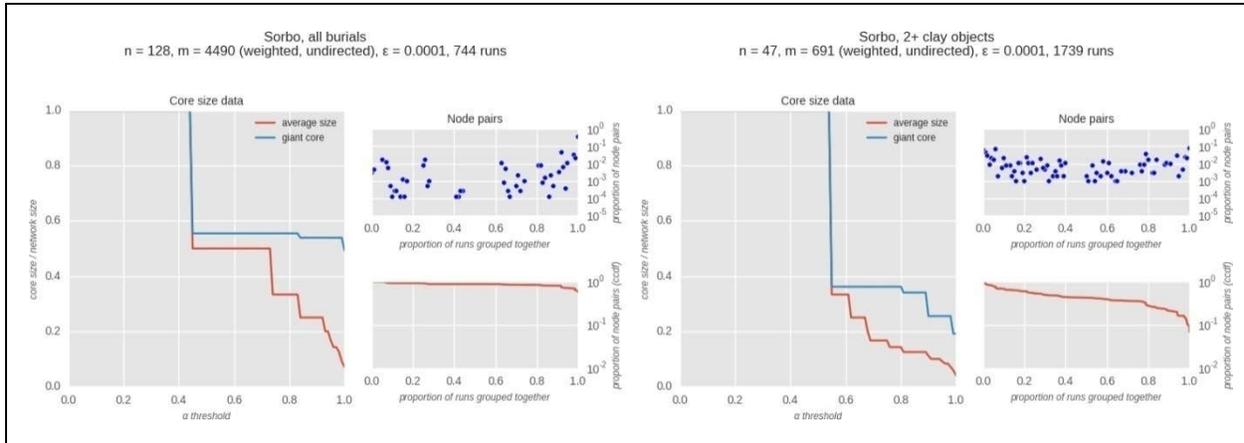


The available sample for network reconstruction includes 66 cremations and 62 inhumations associated with a total of only 238 clay objects. Average assemblage size is the lowest among all subsets represented by 20 or more burials, as is the percentage of assemblages containing at least two objects (table 5.1). Given the magnitude of the discrepancy compared to other samples, it seems likely that preservation, recovery, and/or documentation biases are in play. Although the published data are not sufficiently detailed to determine the state of burials at the time of excavation, heavy erosion had apparently damaged most of them and dispersed some of their contents (Pohl 1972:1).

In light of these observations, it is not surprising that core organization within a network based on the entire sample is anomalous (fig. 5.3). The network is dominated by two large cores over most α thresholds, one of which essentially singles out burials with just one clay object (e.g., core 0.45-1: 71 burials with 1.32 objects on average; 0.45-2: 57 burials, 2.53 objects on average). Consequently, it seems advisable to consider only burials that contain at least two clay objects. This step may seem too drastic in the absence of precise information concerning the state of

preservation of individual burials, but it is important to note that within both samples for which such data are available for the PF 1—Quattro Fontanili and Osteria dell’Osa (Veio and Gabii subsets, respectively)—assemblages containing fewer than two clay objects are significantly associated with evidence for postdepositional disturbances ($n = 466$, $p = 0.0001$; Fisher’s exact test).

FIGURE 5.3 *Networks based on the PF 1 sample from the Sorbo cemetery, Cerveteri (left: all burials; right: burials containing at least two objects).*



Excluding burials with fewer than two objects yields a more structurally plausible representation. As captured by the plot of core size patterns, the network is no longer dominated by only two cores. Despite the reduced sample size, moreover, the p_{ij} distribution appears less polarized. Fewer pairs of nodes are grouped together every run and the rest are distributed more uniformly. No data concerning the sex and age of the deceased are available, as already mentioned, but the sample of burials associated with two or more objects includes both cremations and inhumations (17 and 30, respectively), so that it is possible to evaluate the relationship between disposal mode and network structure. Considering that during this phase inhumations appear to have been the exception within northern TCI, they should perhaps be expected to deviate from other aspects of funerary norms. Even discounting the Bonferroni correction, however, no core comes close to being significantly associated with either disposal mode.

General observations: With regard to survey evidence, the area of Cerveteri conforms to patterns observed elsewhere in northern TCI. Based on fine-grained studies of the funerary evidence, however, it is often suggested that this area was at least partially anomalous. Aside from the size of the excavated sample, Sorbo is notable for ritual innovation. As discussed in section 1.3, the

PF 1 saw the introduction of inhumation and its gradual establishment as the primary disposal mode across southern TCI, but cremation remained preponderant in the north well into PF 2. Sorbo is among the few northern TCI cemeteries to include a considerable number of inhumations along with cremations already in the PF 1 (Bietti Sestieri 2010:261). Recurring elements within assemblages, such as brooches with specific types of attached rings, also provide southern parallels that set this area apart (e.g., Iaia 2000). Particularly with regard to the typology of urns and associated covers within cremations, however, it is possible to draw clear connections to more conventional ‘Villanovan’ cemeteries (e.g., Pacciarelli 2001:244, 247; Iaia and Pacciarelli 2012:347-348, who nevertheless note that the standard ‘Villanovan’ urn shape, while widely distributed at Sorbo, tends to lack the distinctive decoration attested in the areas of Tarquinia and Veio). Even according to conventionally emphasized evidence, therefore, the Cerveteri subset challenges simplistic notions of ‘Villanovan’ versus ‘Latial’ cultural blocks.

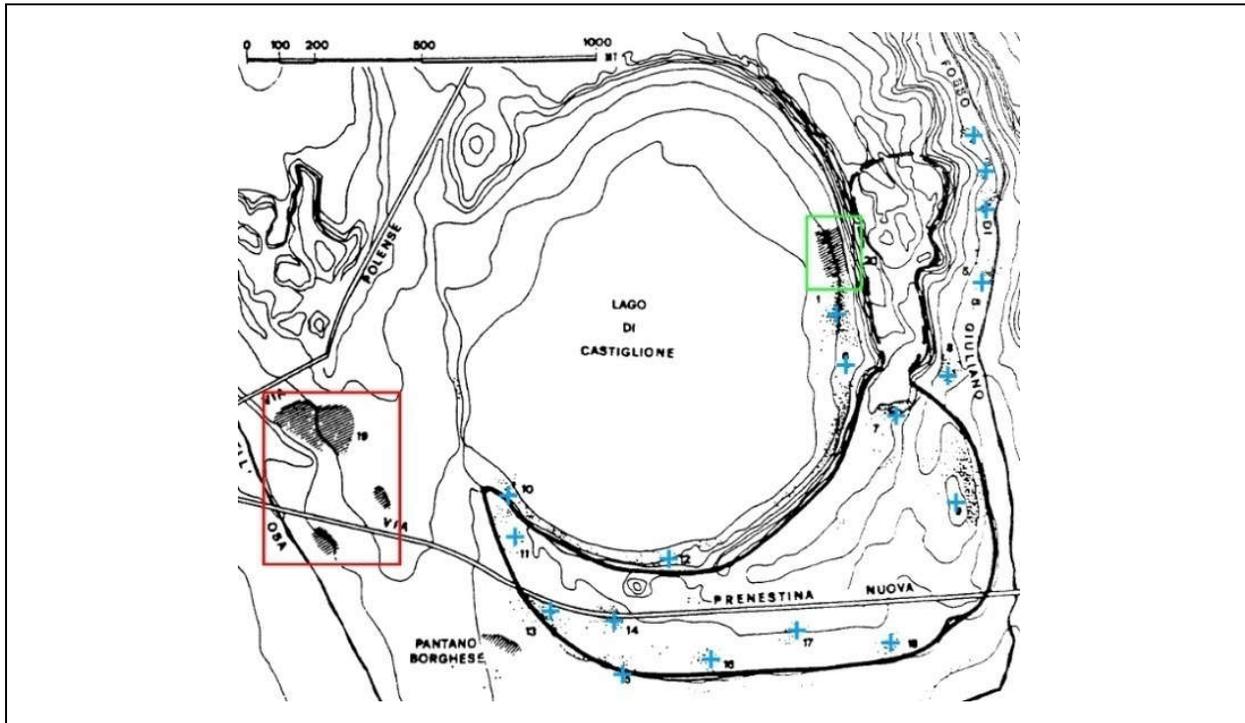
Gabii

Settlement evidence: The area of Gabii presents one of the best parallels from southern TCI for the sorts of discontinuous scatters of PF material attested on the Cerveteri, Tarquinia, and Veio plateaus. Surveys during the 1970s revealed some 17 clusters of sherds along the southern and eastern edges of the volcanic lake of Castiglione (fig. 5.4; compare to the limited extent of Bronze Age scatters in fig. 4.4). As with Bisenzio, the paucity of excavation evidence for the PF 1 and lack of clear geomorphological boundaries make it difficult to gauge the extent of the settlement. Additionally, areas of probable PF habitation were heavily damaged by quarrying activity during the historical period. As a result, estimates of surface area vary widely from approximately 30 to 90 hectares or more (cf. section 7.4; e.g., Pacciarelli 1994:239).

Funerary evidence: At least two cemeteries began to be used in the PF 1—Osteria dell’Osa to the east of the crater and Castiglione on the western ridge. Both sites have been extensively excavated and many aspects of the depositions studied in detail. Osteria dell’Osa has yielded approximately 450 PF 1 burials, over four times as many as Castiglione. Only a few burials from the latter have been published, though the final report is nearing completion (e.g., Bietti Sestieri and De Santis 2000; De Santis 2001a; Bietti Sestieri, De Santis, and Salvadei 2002). Osteria dell’Osa, on the other hand, has been presented through an exhaustive monograph, which includes descriptions and illustrations of all burials and objects (Bietti Sestieri 1992a), and a

synthesis in English, which contextualizes the cemetery within the TCI record and describes some additional statistical analyses (Bietti Sestieri 1992b).

FIGURE 5.4 PF scatters on the site of the historical city of Gabii and location of surrounding cemeteries (scatters marked in blue, Osteria dell’Osa and Castiglione cemeteries in red and green, respectively; the thick black outline encompassing most of the scatters corresponds to the walls of the historical city; adapted from Pacciarelli 2001:122, fig. 67).



While not ruling out that both burial grounds could have pertained to more than one habitation cluster, the excavators lean toward the hypothesis that they represent two independent communities (e.g., Bietti Sestieri 1992b:78). Burials at both sites are characterized by similar material culture and funerary practices (at least in terms of their general features; e.g., cremation versus inhumation), but at Osteria dell’Osa different assemblage configurations are consistently associated with specific age and sex categories, whereas at Castiglione no clear patterns have been detected (Bietti Sestieri 2011). Additionally, it has been noted that individuals buried at Osteria dell’Osa may have had better diets (e.g., Bietti Sestieri, De Santis, and Salvadei 2004), though recent data suggest less marked differences (Catalano et al. 2015). Based on these observations, Osteria dell’Osa and Castiglione are usually presented as evidence for the concurrent development of structurally different and more or less ‘politically’ prominent communities in the area of Gabii: “[PF habitation] in this area was characterized by the

coexistence of multiple settlements within a short distance of one another, likely tied by rather labile political relationships that could be termed of tribal type. The cemetery of Osteria dell’Osa is probably connected to one of the most important settlements; that of Castiglione to a smaller and shorter-lived village” (Bietti Sestieri, De Santis, and Salvadei 2002:220, my translation).¹⁰

Between a third and half of the estimated extent of Osteria dell’Osa has been investigated systematically (cf. section 2.3; summary assessments of the excavated samples presented below are derived from Bietti Sestieri 1992b). Aside from a general underrepresentation of infants, the demographic structure of the PF 1a sample does not present major anomalies. In the case of the PF 1b, the sex ratio among individuals of 20-30 years is skewed toward females. Accounting for these factors and the temporal density of burials according to the traditional chronological span for the PF 1 (approximately 450 burials over 130 years), the excavators estimate that during this phase the hypothetical community represented by the cemetery would have been no larger than 300 individuals.

With regard to the organization of the cemetery, at first glance no clear spatial trends can be identified. Nevertheless, burials were probably not situated at random. Based on the distribution of potential ‘prestige’ markers (e.g., miniature weapons, knives, cremation), broader patterns in assemblage composition (e.g., ‘weaver’ and ‘drinking’ sets), and the results of chronological seriation, the excavators reconstruct two original clusters, each corresponding to an extended family, and several groups of descendants. Groupings that appeared to be undisturbed at the time of excavation range in size from 28 to 53 burials and on average span approximately 30 years. While most studies of the cemetery agree with the outlines of this spatial subdivision, its implications are debated. Where the excavators see evidence for segmentary organization at least until the very end of the PF 1, others reconstruct hereditary clans in an advanced stage of competition over the “means of production” (e.g., Pacciarelli 2001:240-242, 255-259).

Most of the PF 1 burials excavated at Osteria dell’Osa supplied appropriate data for network

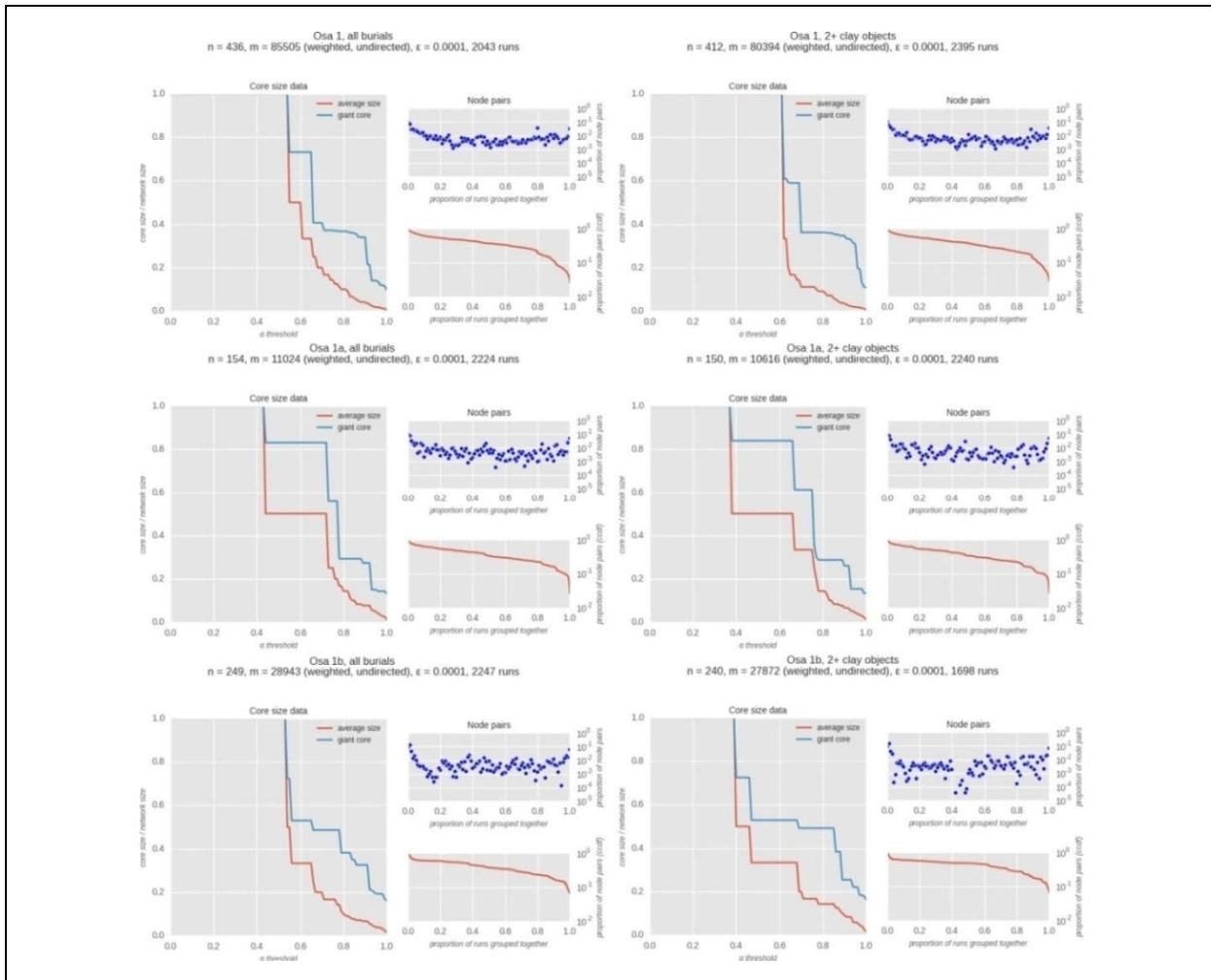
¹⁰ “La distanza che separa i due complessi indica che si tratta delle necropoli di due gruppi di popolazione distinti, insediati in punti diversi del cratere di Castiglione. Come già proposto [...], questo sembra indicare la probabilità che l’insediamento nella prima età del ferro [...] in questa zona fosse caratterizzato dalla coesistenza di più abitati a breve distanza gli uni dagli altri, verosimilmente legati da rapporti politici piuttosto labili che si potrebbero definire di tipo tribale. La necropoli di Osteria dell’Osa appartiene probabilmente a uno degli abitati più importanti; quella di Castiglione a un villaggio minore e di durata più breve”

reconstruction (table 5.2). Core structure appears coherent even when including assemblages containing only one object (fig. 5.5). For the sake of consistency with other samples, however, it may be advisable to remove such burials, and it is reassuring to note that doing so does not alter core structure markedly.

TABLE 5.2 *Chronological breakdown of the PF 1 sample from Osteria dell'Osa by sex, age, and ritual (for sex and age, bioarchaeological determinations only).*

Phase	Sex			Age					Ritual		Phase total
	F	M	ind.	<13	13-18	18-50	>50	ind.	cr.	in.	
PF 1a	54	39	63	33	11	74	36	2	24	132	156
PF 1b	74	71	104	43	17	138	44	7	8	241	249
PF 1 gen.	10	3	20	4	0	15	5	9	4	29	33
Total	138	113	187	80	28	227	85	18	36	402	438

FIGURE 5.5 *Networks based on the PF 1 sample from the Osteria dell'Osa cemetery, Gabii (left: all burials; right: burials containing at least two objects; from top to bottom, PF 1 as a whole, PF 1a, and PF 1b).*



In both cases, considering the entire sample produces more convincing patterns than splitting it by subphase. As discussed in section 2.3, this may reflect a genuine characteristic of PF 1 vernaculars rather than the effect of decreased sample size. Suffice it to note that, of the two subphase samples, the smaller one from the PF 1a results in more plausible structure.

Owing to the comprehensive publication of all burials from Osteria dell'Osa, it is possible to evaluate the relationship between non-spatial variables and network structure in detail. Especially in light of the links between demographic variables and assemblage composition observed by the excavators, cores might be expected to home in on specific age and sex categories. Surprisingly, however, demographic variables account for few significant associations compared to chronological subdivisions of the PF 1 and the spatial groupings identified by the excavators. More important, all such associations—demographic, chronological, and spatial—are driven by the relative prevalence of cremations versus inhumations within the various branches of the network. Residuals are comparable across the board at relatively low α thresholds (starting at 0.62), where cores are largest, but phi/phimax values indicate greater association strength between cores and ritual type. At higher thresholds, both residuals and phi/phimax consistently point to ritual type as the determining factor for core composition.

General observations: The underrepresentation of children younger than two years at Osteria dell'Osa probably reflects the widespread practice of burying infants in domestic contexts. For example, burials of this type from the PF 2 and the immediately subsequent period were recently excavated within the settlement area at Gabii (section 6.1; Becker and Nowlin 2011; Mogetta and Becker 2014:176-177). The PF 1b anomaly in the sex ratio among individuals of 20-30 years is more difficult to explain. One possibility is that it could reflect a deliberate change in funerary practices over the course of the PF 1. Specifically, the frequency of cremations drops sharply between the PF 1a and PF 1b samples; in light of the fact that males of 20-30 years account for a high proportion of PF 1a cremations, the excavators suggest that individuals who would have been cremated under PF 1a norms were gradually excluded from burial with the rest of the community or accorded distinctive treatment that left no archaeological traces (e.g., Bietti Sestieri 1992b:121).

Such interpretations hinge on broader assumptions concerning the changing status of weapon-bearing adults around the BF-PF transition. Cremations of the type that appears to be ‘missing’ from the PF 1b frequently include miniature representations of spears, swords, and other weapons. Discounting rare instances of sheet-metal arrowheads, the miniature weapons within such cremations constitute the only apparent indicators of martial status encountered within PF 1 Osteria dell’Osa. In this respect, Osteria dell’Osa conforms to a trend attested throughout TCI. In the Middle Bronze Age and the early phases of the Late Bronze Age, weapons were deposited alongside other grave goods in many burials. Then, in parallel with the adoption of cremation in the BF and down to the end of the PF 1, functional weapons virtually disappear from the funerary record. This development tends to be interpreted as evidence for ideologically driven restrictions on the expression of warrior identity associated with the concentration of power in the hands of few individuals (e.g., Peroni 1994; Bietti Sestieri 2011). If this general perspective is accepted, it becomes relatively straightforward to explain the PF 1b demographic anomaly at Osteria dell’Osa in terms of further ideological restrictions.

Alternatively, the decreased frequency of ‘martial’ burials at Osteria dell’Osa may reflect directly a spike in intersite conflict in the late PF 1. In this scenario, rather than symbolizing decision-making power abstractly, the inclusion of weapons in burials would have been reserved for individuals who actually engaged in warfare. If conflict intensified in scale, frequency, and/or brutality during the PF 1, the number of such individuals whose remains would have been available for formal interment could have substantially diminished.

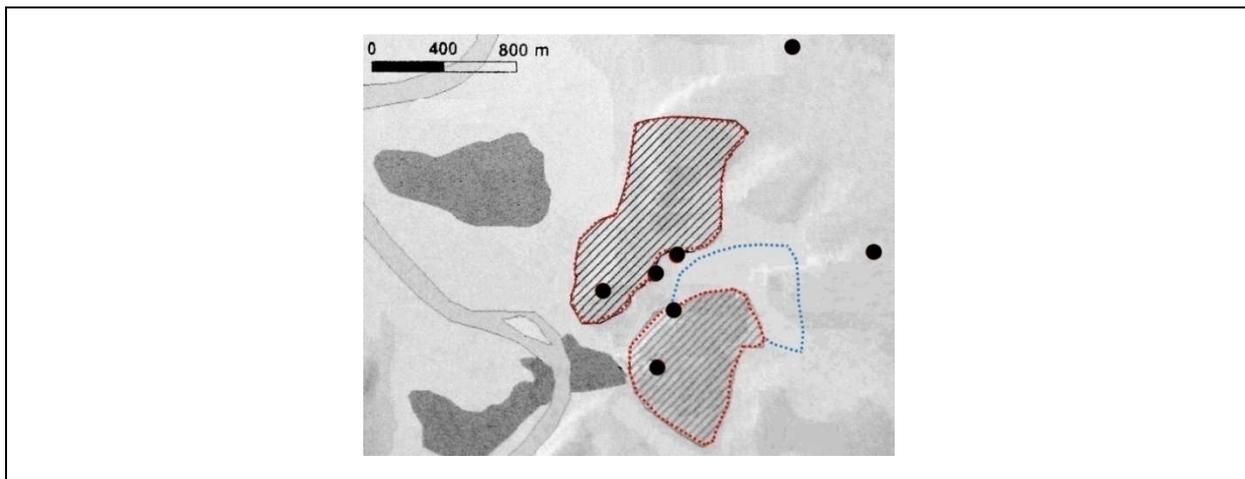
The available data are not sufficient to evaluate these possibilities systematically. With regard to the significance of cremation and the miniaturization of weapons and other objects, it seems likely that no amount of archaeological or other evidence could elevate the discussion beyond the level of speculation. Still, highlighting these sorts of ambiguities is worthwhile given the tendency to jump to ideological conclusions in the study of TCI mortuary variability. To cite another example, certain types of knives, possible representations of double shields, and small clay statuettes of ‘offerers’ are routinely interpreted as markers of some form of religious leadership (e.g., Bietti Sestieri 1992a:496). The distribution of scarce or otherwise unexpected items is certainly an important facet of mortuary variability, but in the case of Osteria dell’Osa and other TCI contexts it is used to weave an idealist narrative driven by stylized warriors and

priests (occasionally warrior-priests).

Rome

Settlement evidence: Along with Gabii, Rome is often cited as an exception to the ‘rule’ of smaller-scale and slightly later developmental processes within southern TCI. PF 1 evidence has been attested over substantial portions of the area occupied by the historical city (fig. 5.6). As in the case of Gabii, habitation was almost certainly discontinuous. The articulated topography of Rome, however, makes it is easier to estimate at least the outline of settled areas, which at this time were probably restricted to elevated features safe from the seasonal floods of the Tiber. The total extent of these settled areas may have approached or slightly exceeded 100 hectares (recently, Fulminante 2014), though more conservative readings of the evidence have also been proposed (e.g., Cazzella 2001).

FIGURE 5.6 *Location of PF 1 funerary contexts and hypothetical extent of habitation areas at Rome (adapted from Fulminante 2014:73-74, figs. 17-18; black markers indicate PF 1a funerary contexts, dark grey features possible wetlands, and dotted outlines habitation areas; early PF 1 in red, extension by the PF 1b in blue).*

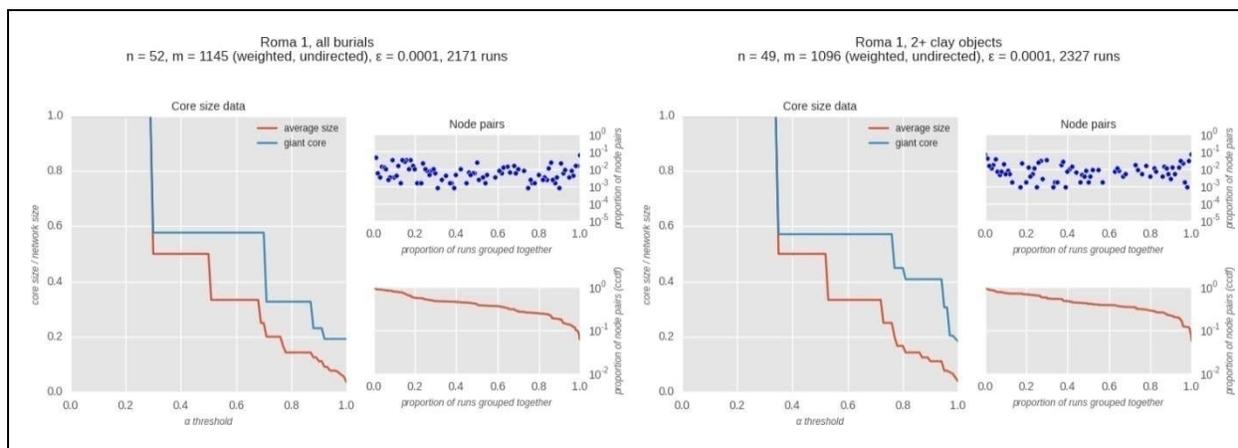


Funerary evidence: The majority of published burials were excavated in the late 19th and early 20th centuries (data collected in Gjerstad 1956). Fortunately, the associated documentation is better than in the case of Bisenzio, Cerveteri, and Tarquinia, and more recently excavated burials seem to corroborate patterns of assemblage composition inferred from the earlier evidence (e.g., De Santis 2003).

A total of 52 burials were associated with suitable assemblages for network reconstruction (16 cremations and 36 inhumations). Cemeteries in the area of the later Forum—between the two

habitation areas illustrated in figure 5.6—and on the Esquiline to the east are particularly well represented in the sample. The relative chronology of these contexts was considered in detail as part of the important attempt to reconcile southern TCI chronologies discussed in section 2.3 (Bettelli 1997). Based on that framework, the sample is approximately evenly split between the PF 1a and PF 1b (24 and 28 burials, respectively). A representation of the entire sample displays relatively coherent structural patterns (fig. 5.7). Only three burials include fewer than two objects, and their removal has little impact.

FIGURE 5.7 Networks based on the PF 1 sample from the Forum and Esquiline cemeteries, Rome (left: all burials; right: burials containing at least two objects).



The available bioarchaeological data are insufficient to examine the relationship between network structure and demographic variables systematically. In terms of other non-spatial variables, cores at high α thresholds tend to isolate either cremations or inhumations and PF 1a or PF 1b burials. As in the case of Osteria dell’Osa, however, higher residuals and phi/phimax values point to disposal mode as the determining factor.

General observations: The debate over the original extent and expansion of habitation at Rome during the PF has become extremely complex (comprehensive assessments are provided in Smith 1996 and Fulminante 2014). Intensive urban development from the early historical period to the present has rendered inaccessible or destroyed PF deposits in many areas, so that the material evidence remains fragmentary despite the unparalleled intensity of archaeological research compared to other TCI centers. Both for this reason and as a result of the disciplinary trends introduced in section 1.3, later literary accounts, toponyms, and other non-archaeological sources have had a significant impact on the discussion (Momigliano 1963; Ampolo 1983; Grandazzi

1991; Cornell 1995; Carandini 1997).

The level of detail achieved through such work is beyond the scope of this outline, but it may be useful to consider briefly a prominent example of the intersection of archaeological and historical evidence. Historical sources, including possible records of early Roman laws, attest to restrictions and outright prohibitions on burying adults within city limits (for a review, see Vanzetti 2008:748-751). In large part on the strength of this evidence, changes in the location of funerary areas are frequently invoked within reconstructions of the process of settlement intensification, which generally envision villages on elevated topographic features expanding and eventually merging (e.g., Müller-Karpe 1962; Peroni 1977; Colonna 1988). In the PF 1, burial grounds close to the presumed habitation areas appear to have been abandoned in favor of ones to the northeast and east (the historical Esquiline). Then, over the course of the PF 2, these funerary areas were progressively moved farther away from the core of the settlement (cf. section 6.1).

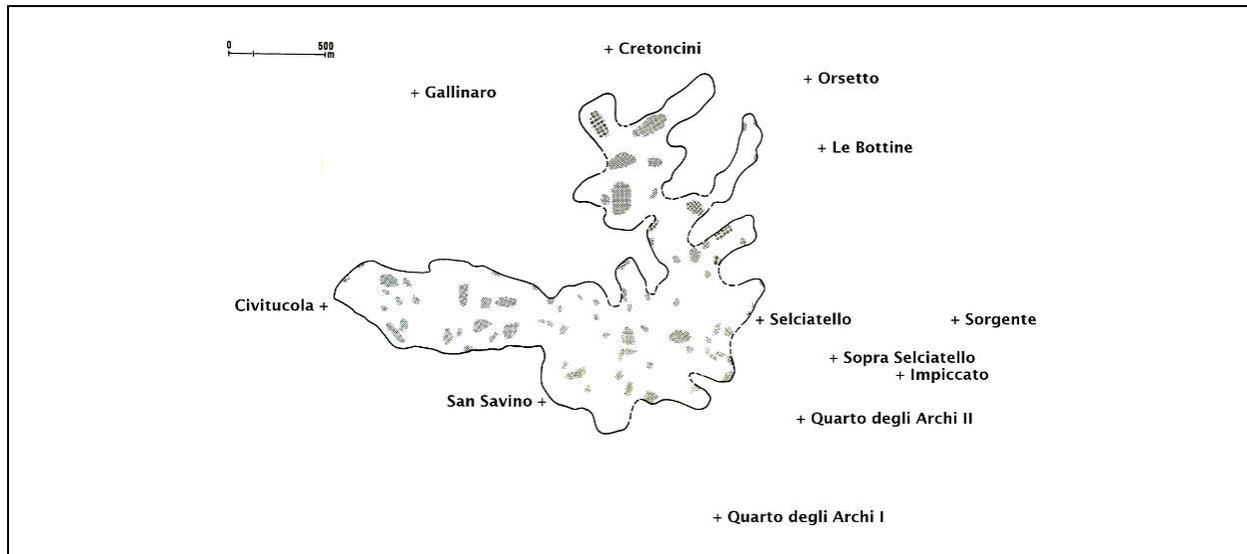
Although the relocation of burial grounds is an interesting phenomenon, it is important to note that recent excavations within hypothesized PF habitation and activity areas have uncovered ‘exceptions’ to the widely cited pattern of burying adults exclusively outside of settlements. Several PF 2 instances are outlined in section 6.1; for the PF 1, examples include an inhumation from Rome itself and two from different parts of the Veio plateau. The former belonged to a male of approximately 17 years and included a cup and a bowl datable to the PF 1a (Lugli, Brincatt, and Micarelli 2001:311). Along with three inhumations of young children, it was situated close to a metalworking area on the Capitoline (the upper settlement area in figure 5.6; De Santis 2001b:273; Albertoni 2001; the Veio burials may also have been associated with productive areas; see below).

Tarquinia

Settlement evidence: Owing to a relatively recent survey and a long-running excavation project, Tarquinia and its territory offer an unusually detailed case study for the BF-PF transition (survey: Mandolesi 1999; excavation: Bonghi Jovino 2010; note that the location of the modern town of Tarquinia does not correspond to that of the PF center and historical city). On the whole, the survey evidence points to the usual process of abandonment of small BF settlements and

convergence of population on a large volcanic plateau—in this case the Civita, with an extent of approximately 120 hectares (fig. 5.8; cf. fig. 4.7). The ‘Area Sacra’ introduced in section 4.1 continued to be used through the PF 1, with major developments attested toward the end of the period and the beginning of the PF 2 (section 6.1).

FIGURE 5.8 *PF 1 scatters on the site of the historical city of Tarquinii and location of surrounding cemeteries (adapted from Mandolesi 1999:139, fig. 63, and 149, fig. 65).*



The articulation of the surrounding territory is better documented than for most other subsets of TCI. The Monterozzi hill, around two kilometers southwest of the main plateau, preserves scattered evidence for new occupation during the PF 1 (as well as several cemeteries; see below). Aside from the survey data, excavations in the 1970s brought to light the largest sample of PF huts from TCI (Calvario site; Linington, Delpino, and Pallottino 1978). Unfortunately, the PF stratigraphy was heavily disturbed, so that the chronology and organization of the settlement could not be evaluated in detail. More than 20 structures were documented over an area of two hectares, and the settlement appears to have been abandoned during the early PF 2. In addition to Monterozzi, there are traces of activity near the coast (cf. the case of Cerveteri). Along with few other possible habitation scatters, this evidence has been used to reconstruct a process of strategic occupation of the landscape aimed at defending the emerging center and fostering its economic interests (Mandolesi 1999:194-204).

Funerary evidence: The data from Tarquinia best illustrate the shift from the isolated burial grounds attested in the BF to multiple cemeteries clustered around settlement areas. At least a

dozen funerary contexts have been recorded in the immediate vicinity of the main plateau through a combination of survey and excavation (fig. 5.8; summary descriptions provided in Mandolesi 1999:146-154). The presence of so many burial grounds is somewhat surprising, and in fact it has been argued that some of the more clustered sites could have made up larger cemeteries (e.g., Impiccato and Selciatello di Sopra southeast of the plateau; Mandolesi 1999:150-152; Iaia 1999:69 and references therein). Additional cemeteries were associated with nearby Monterozzi. Of these, only Le Rose has been fully published (Buranelli 1983, based on excavation data from the early 1950s; cf. Moretti 1959; the final report of the more recent work at Villa Bruschi Falgari is in preparation, though select data have been made available; e.g., Trucco et al. 2005).

Since the late 19th century, increasingly systematic excavations at many of these sites have brought to light over 700 burials. A comprehensive review of all the available data appeared nearly fifty years ago (Hencken 1968). More recently, the 320 best documented burials were analyzed systematically as part of a comparative study of PF 1 mortuary practices in northern TCI (Iaia 1999). Even for these burials it is difficult to refine chronological attributions to the subphase level, though a small PF 1a-1b1 component can perhaps be distinguished from a larger sample that spills into the very beginning of the PF 2 (PF 2a1; Iaia 1999:14 ff.).

Le Rose at Monterozzi and Poggio dell'Impiccato, Poggio Selciatello, and Poggio Selciatello di Sopra on the eastern boundary of the Civita plateau are the main sources of burials with suitable assemblages for network reconstruction (table 5.3). As in the case of Cerveteri, the low percentages of burials associated with fewer than two clay objects may reflect preservation, recovery, and/or documentation biases. Early excavation accounts frequently mention that graves appeared to have been looted or otherwise disturbed, and the post-excavation history of the assemblages is a further source of concern (Iaia 1999:13-14). Considering only burials that contain two or more objects produces a better representation than including the entire sample (fig. 5.10). Still, it is worth considering whether more plausible structural patterns can be obtained by further subdividing the dataset.

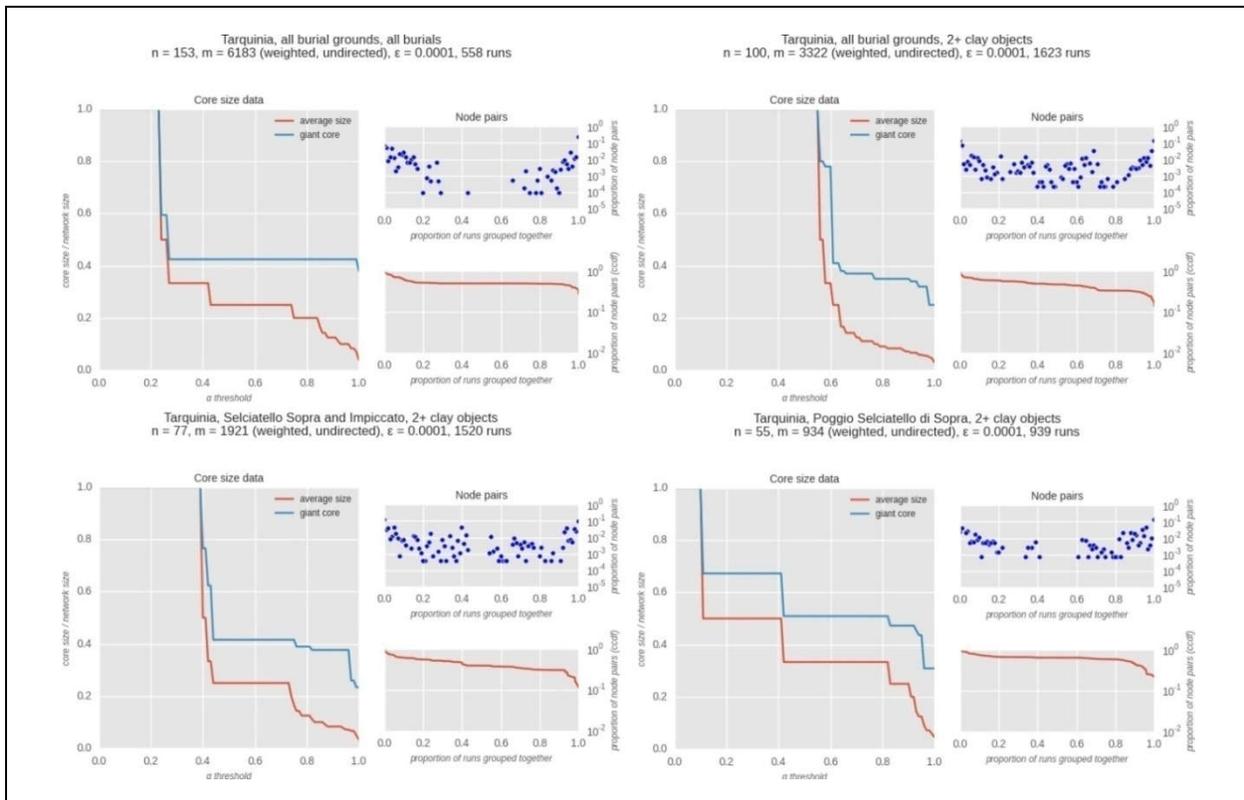
The burial grounds represented in the full network could reflect specific demographic segments or vertical social strata. Although bioarchaeological determinations of age, sex, health, and other

relevant factors are not available, recent studies have attempted to tackle this issue by analyzing assemblage composition as well as patterns in the form of the interments and their spatial organization (Iaia 1999; Pacciarelli 2001). Based on such evidence, it would appear that individual burial grounds encompassed multiple demographically coherent family groups. Elements conventionally attributed to wealthy and/or high-status burials, however, are not distributed homogeneously.

TABLE 5.3 Sample characteristics for burial grounds associated with the area of Tarquinia (PF 1 and very beginning of PF 2).

Burial ground	Total burials	Cremations	Inhumations	Total clay objects	Burials with 2+ objects (%)	Average number of objects		
						all burials	crem.	inh.
Impiccato	30	21	9	104	0.73	3.47	3.71	2.89
Le Rose	11	11	0	28	0.55	2.55	2.55	N/A
Selciatello	31	31	0	92	0.55	2.97	2.97	N/A
Selc. Sopra	81	81	0	225	0.68	2.78	2.78	N/A

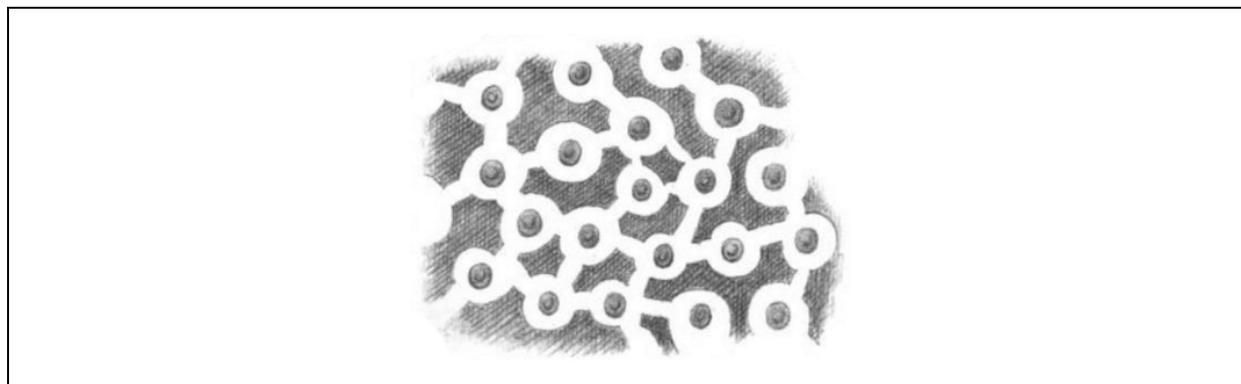
FIGURE 5.9 Networks based on PF 1 samples from Tarquinia (top left: all cemeteries and burials; top right: all cemeteries, burials containing at least two objects; bottom left: Poggio Selciatello di Sopra and Poggio dell'Impiccato, burials containing at least two objects; bottom right: Poggio Selciatello di Sopra, burials containing at least two objects).



Impiccato and Selciatello di Sopra supply a good case study. As already mentioned, these burial grounds may have formed part of a single large cemetery, so that isolating them from the rest of the sample could be expected to yield more coherent structure. Additionally, given that Selciatello di Sopra features fewer conventionally recognized ‘prestige’ markers (Iaia 1999:69-71), it is also interesting to consider them individually. If anything, however, the resulting networks are less coherent than the one based on the entire sample (Selciatello di Sopra shown individually and with Impiccato in fig. 5.10).

General observations: While extensive, in many ways the funerary record from Tarquinia is just barely detailed enough to offer a sobering glimpse of the extent of the information that is missing from much of TCI. The case of the spatial organization of certain sectors of the Arcatelle burial ground on Monterozzi is illustrative. A concentration of more than 80 cremations was documented in the late 19th century within an area of approximately 100 square meters (Iaia 1999:66-68; cf. Hencken 1968:20 ff.). Two early accounts describe several clusters of burial pits linked by deep channels (Ghirardini 1881:343; Helbig 1882:11). Unfortunately, many of the burials were found heavily disturbed and the remainder was not well documented (Helbig 1882:12 records that just 36 burials appeared intact). Only a sketch of one of the networks is known (fig. 5.9).

FIGURE 5.10 *Sketch of channels linking burial pits at Arcatelle (Monterozzi, Tarquinia; adapted from Ghirardini 1881, table 5.1).*



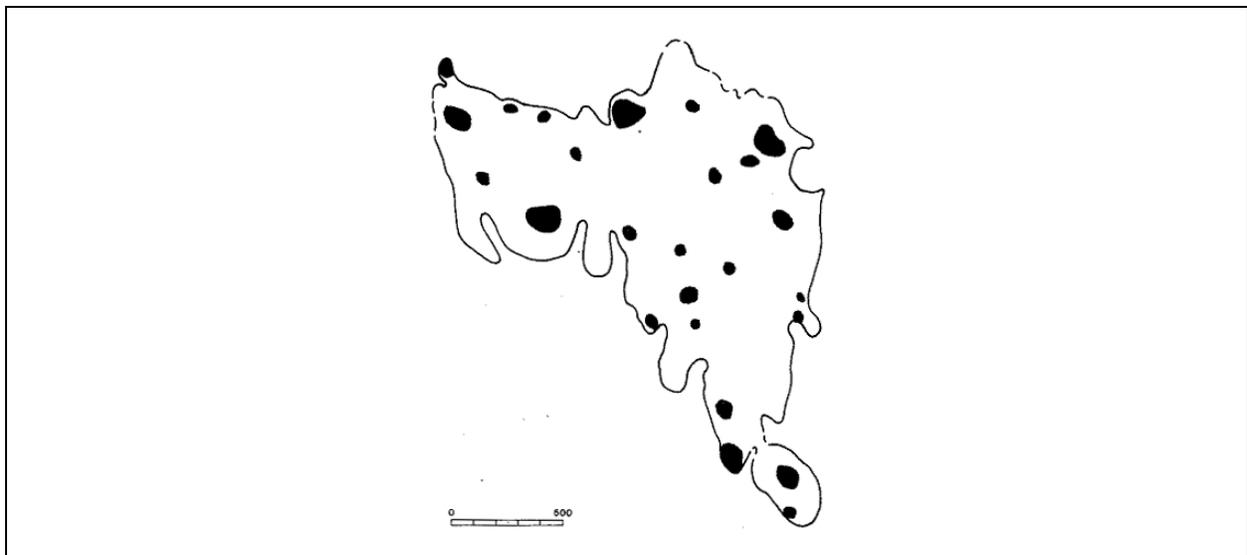
One of the original observers proposed that the channels could have been functionally related to the excavation of the burial pits (Helbig 1882:11). Slightly better data from funerary areas associated with Vulci suggest otherwise. In particular, links within ‘networks’ at the Ponterotto cemetery appear to define male-female pairs and potentially more complex status-based

relationships (Iaia 1999:66-67, 91).

Veio

Settlement evidence: Data for the surrounding territory are not as substantial as in the case of Tarquinia or even Cerveteri, but the area of the major center is known through both survey and excavation. The surface evidence points to scattered occupation over much of the plateau, which at 175 hectares ranks as the largest of northern TCI. Major clusters are concentrated along the edges, perhaps suggesting an articulated internal organization (fig. 5.11). Recent excavations have produced interesting sequences from the PF 1, including two huts associated with pottery production features and rare non-infant burials (see below for the burials; Boitani, Neri, and Biagi 2008; Acconcia and Bartoloni 2014).

FIGURE 5.11 *PF scatters on the site of the historical city of Veii (adapted from Pacciarelli 1991:187, fig. 8a; scale in meters).*



Funerary evidence: Major cemeteries that have yielded PF 1 components include Grotta Gramiccia immediately northwest of the plateau and Quattro Fontanili to the northwest. Only a few burials from the former can be analyzed, as the site was excavated in the early 20th century and subsequent studies have not been fully published (e.g., Berardinetti and Drago 1997). Quattro Fontanili, on the other hand, was excavated and published systematically in the 1960s and 1970s, and in fact it provides the best PF 2 sample from TCI. The majority of PF 1 burials, however, were destroyed or heavily disturbed by agricultural work. Those that appear well

preserved and are accompanied by suitable assemblages for network reconstruction, while included in the aggregate network, constitute too small a sample for subset-specific analysis.

Additionally, excavations within settled areas uncovered two adult interments. Both were located within huts close to probable pottery production features and rank among the earliest PF inhumations from northern TCI. One pertains to a female individual and was excavated in the northwestern sector of the plateau (Campetti site; Boitani, Neri, and Biagi 2008). The other individual, a male, was buried at the southern extremity of the plateau (Piazza d'Armi, actually a tenuously connected topographic feature; Bartoloni 2003b). Although the burials are plain, in light of subsequent monumental developments they tend to be ascribed to socially important individuals—in the second case even a settlement 'founder' (cf. section 6.1).

2. BASE FOR RELATIONAL RECONSTRUCTION

The aggregate sample for the PF 1 encompasses 732 assemblages containing two or more clay objects. On the whole, the most obvious structural feature of the reconstructed network is its cohesiveness until high α thresholds (fig. 5.12). Even after the initial break, up to a threshold of 0.78, the network is dominated by a giant core comprising over 98 percent of the burials. Given that it supplies over half of the burials in the sample, it seems likely that the Gabii subset is at least partially responsible. This is reflected in the split of the aggregate network at 0.78, when the giant core sheds over 100 burials from Osteria dell'Osa (rightmost branch in the dendrogram). Inhumations and subphase 1b burials are particularly overrepresented in the base core of the resulting branch (residuals of 8.176 and 8.163, respectively). As mentioned in the preceding section, disposal mode and subphase membership are frequently associated within the Gabii- and Rome-specific networks, and in this case as well phi/phimax values point to disposal mode as the determining factor (-0.543 for inhumation, -0.392 for subphase 1b).

In terms of the object configurations underlying this branching event, the presence of shoulder-handled jugs seems especially relevant (residuals of 12.852 for single instances and 18.061 for pairs). This object, usually termed 'orciolo' in the specialist literature, occurs most frequently within southern TCI, though many examples are also attested in the north (e.g., at Cerveteri and Tarquinia). Its occurrence in pairs, however, is largely confined to the Gabii subset. Based on

systematic studies of their inclusion within ‘drinking sets’ at Osteria dell’Osa and broader distribution across TCI, it has been argued that orcioli may have been functionally interchangeable with other probable liquid containers—especially neck-handled jugs (fig. 5.13; see discussion in Belardelli et al. 1999). Accordingly, it becomes interesting to evaluate the effect of merging these forms on core structure and composition.

FIGURE 5.12 *PF 1 aggregate network (burials associated with two or more objects; bottom: major branching events and core-spatial subset statistical associations; color opacity corresponds to the magnitude of adjusted residuals, with gray indicating values between zero and two).*

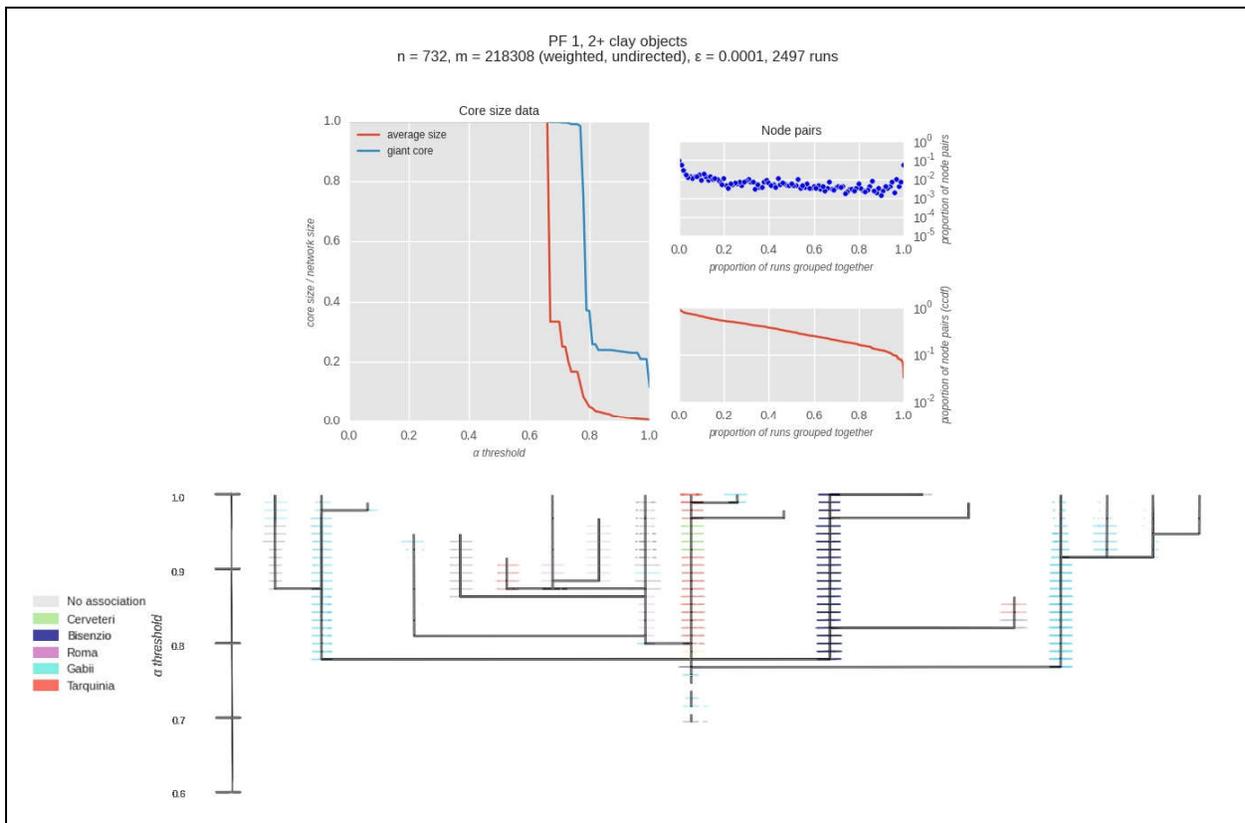


FIGURE 5.13 *Examples of shoulder- and neck-handled jugs from burial 19 at Selciatello di Sopra (Tarquinia, PF 1; adapted from Hencken 1968:245, fig. 223).*



The network produced by merging shoulder- and neck-handled jugs begins fragmenting at similarly high thresholds, but in this case the first substantial split of the giant core isolates moderate numbers of burials from Cerveteri, Tarquinia, and Veio rather than a substantial proportion of the Gabii component. Already by a threshold of 0.81, however, the two networks converge on nearly identical subdivisions. In light of the potential for classificatory or other inaccuracies inherent in coding a dataset as large as the one considered here, which in a context of unstandardized household production is compounded by the incidence of formally ambiguous objects, this is a reassuring indication of the robustness of the approach. Given the essential equivalence of the two networks, the remainder of this section treats exclusively the one illustrated in figure 5.12.

Returning to the branching event at 0.78, the isolation of a substantial proportion of inhumations from Osteria dell'Osa highlights the importance of monitoring the composition of cores in terms of disposal mode. Threshold 0.79 breaks off over a quarter of the sample into a single core (195 burials total), giving rise to a branch that dominates the network over the remaining thresholds (second major branch from the right in the dendrogram). The largest component of this branch still includes 153 burials at threshold 0.99, and even at the highest level of the network, after all but the most closely related nodes have been weeded out, it is nearly twice the size of the second largest core (85 versus 45 nodes).

With regard to spatial associations, Bisenzio and the 'minor' site of San Giuliano are significantly overrepresented (residuals of 11.776 and 5.690). Tarquinia is attested approximately as expected at 0.79, but as higher thresholds are applied it loses weakly connected burials at a high rate, so that Bisenzio and San Giuliano become relatively more dominant. In the process, the latter are revealed as especially homogeneous exponents of a dense cluster of cremations concentrated in the interior of TCI. The clearest indication of strong affinities among inland cremations is supplied by the representation of the Gabii subset within this branch. Although overall there are fewer burials from Osteria dell'Osa than expected, its cremations are actually overrepresented already at 0.79 (residuals of -11.083 for all Osteria dell'Osa burials, 6.935 for cremations, -13.881 for inhumations). As in the case of Bisenzio and San Giuliano, moreover, at higher thresholds the Osteria dell'Osa component retains much of its integrity compared to Tarquinia.

These patterns of association are indicative of the utility of seeking alternative relational planes and scales of resolution. Though located within 25-30 kilometers of both Cerveteri and Tarquinia, San Giuliano is frequently presented as a satellite of the latter or at the very least a clear exponent of the ‘Villanovan’ cultural sphere emanating from it (e.g., Iaia 1999:125; a process of ‘colonization’ is hypothesized in Pacciarelli 1991:168 based on a seminal discussion of territorial subdivisions in di Gennaro 1982). Such assessments proceed in large part from similarities among the types of urns and urn-covers attested at the sites as well as combinations of objects such as brooches, razors, and pendants, which in accordance with the theoretical grounds established in chapter 2 are not included in the dataset for network reconstruction.

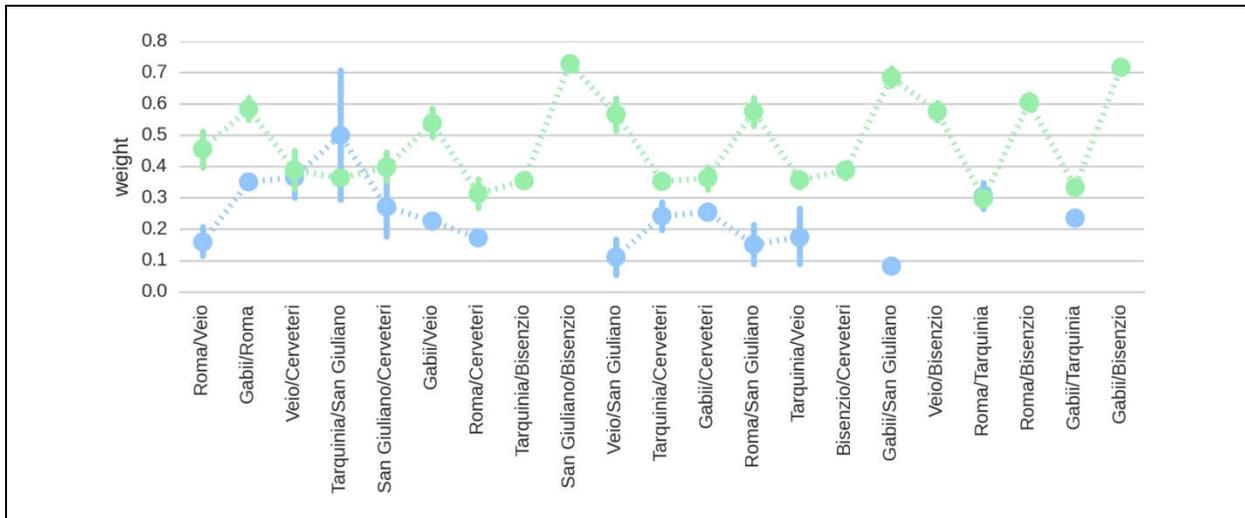
The same facets of mortuary variability point to Bisenzio as a conservative outlier (Delpino 1977; Iaia 1999:125-126; Iaia and Pacciarelli 2012:353-354). In combination with the smaller extent and topographic peculiarities of the settled area compared to other northern centers, the apparent exclusion of Bisenzio from the ‘Villanovan’ phenomenon has led to its frequent characterization as a developmental anomaly (section 5.1). Even on the basis of traditionally emphasized lines of evidence, however, Bisenzio cannot be explained away easily: “that a slower pace of development, less influenced by the great currents of exchange and cultural interrelations that dominated the [PF 1], could have contributed to the conservative outlook of funerary practices at [Bisenzio] is not an entirely satisfying explanation if we keep in mind the entirely different character of the Bisenzio facies over the course of subsequent phases” (Iaia 1999:126, my translation).¹¹

Within the reconstructed network, in contrast, there is no evidence for a ‘Villanovan’ sphere of influence extending to San Giuliano but somehow bypassing Bisenzio. The patterns of core composition discussed above suggest that the Bisenzio and San Giuliano samples are more internally cohesive than average but otherwise closely connected with burials from a broad range of inland subsets. At the same time, the strong association between many cores and either cremation or inhumation cautions against deriving summary relational measures indiscriminately

¹¹ “Che uno sviluppo con ritmi più lenti, meno esposto alle grandi correnti di scambio e di interrelazione culturale che dominano nella prima età del Ferro iniziale la costa tirrenica, possa aver contribuito ad alimentare l’aspetto tradizionalista delle pratiche funerarie di questo centro fino alla fase IIA, è una spiegazione che non ci soddisfa del tutto, se poniamo in mente i caratteri totalmente diversi assunti dalla *facies* visentina nel corso delle fasi successive: ricchissima produzione metallurgica, grande apertura agli influssi stilisti di matrice greco-geometrica provenienti da Vulci, fasto aristocratico con coloriture ellenizzanti [...]”

from all edges in the network. As demonstrated by the representation of the Gabii subset within the ‘Bisenzio-San Giuliano’ branch, distinguishing burials according to disposal mode can reveal important affinities. Accordingly, it seems advisable to derive summary measures separately for cremations and inhumations (fig. 5.14).

FIGURE 5.14 *Averages of site vs. site p_{ij} distributions for the PF 1 (sorted by spatial distance; cremations in green, inhumations in blue; note that the dashed lines are provided exclusively to facilitate comparison and underscore the presence of both data points when they take similar values; vertical bars indicate 95 percent bootstrap confidence intervals for each average).*



The averages derived from cremations lend support to the possibility that Bisenzio, Gabii, Rome, San Giuliano, and Veio could have been part of an inland corridor spanning TCI longitudinally. Edges involving these subsets on average are associated with higher p_{ij} values than those between them and the coastal areas of northern TCI. With few exceptions, the corresponding averages derived from inhumations are substantially lower. On the whole, then, the cremations suggest the possibility of only partially overlapping inland and maritime circuits, while the inhumations point to a more heterogeneous relational landscape. These patterns are best captured spatially (fig. 5.16; normalized numerical data are presented in table 5.4 at the end of the chapter). Although connections across the Tiber are still evident within the inhumation network, Gabii and Rome are more strongly tied to Cerveteri and Tarquinia than the interior northern subsets.

Two possibilities may account for the differences between the cremation and inhumation networks. As a result of the limited number of inhumations within northern TCI, the latter may

simply be misleading. That is, given that in this phase inhumations are essentially limited to southern TCI, Cerveteri, and Tarquinia, it is not surprising that Gabii and Rome appear more closely linked to the coast than in the cremation network. More likely, a temporal shift may be in play. Despite the lack of chronological resolution for the PF 1, it is generally agreed that the few northern inhumations should be placed toward the end of the period, while Osteria dell’Osa in particular suggests that in the south cremations were largely confined to the PF 1a. Overall, then, the cremation network may represent a slightly earlier horizon of the PF 1. Comparison with BF and PF 2 patterns in chapter 7 may help assess the plausibility of this assumption.

FIGURE 5.15 PF 1 relational patterns derived from average p_{ij} values (left: cremations; right: inhumations; edge thickness corresponds to normalized values listed in table 5.4; node and edge colors reflect topological communities, with inter-community edges in grey; circular layouts provided on the bottom left for reference).

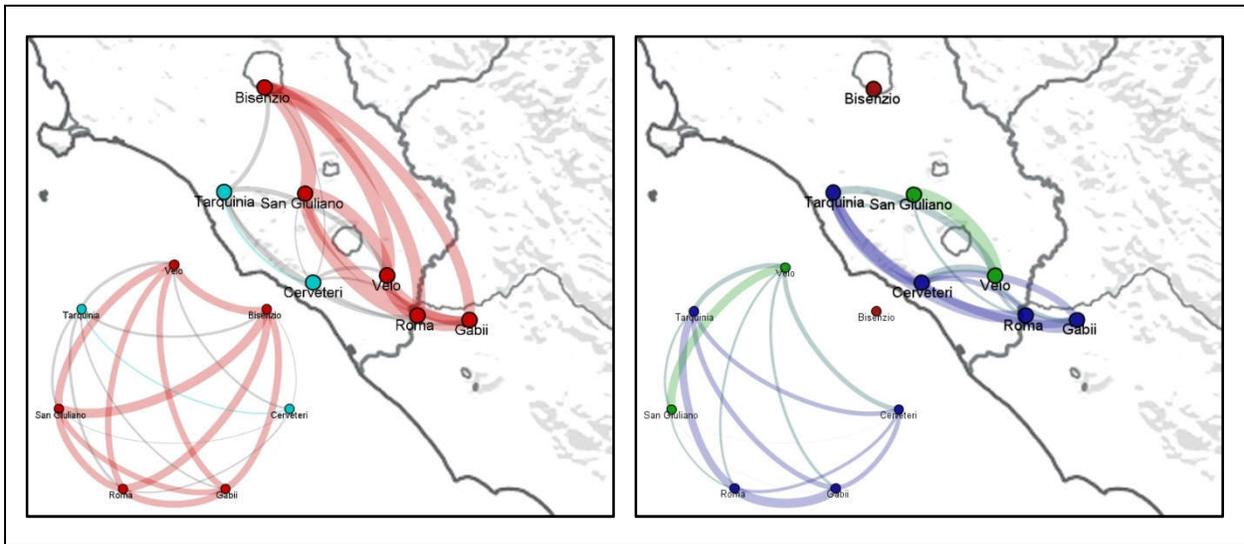


TABLE 5.4 *Spatial distances and subset-vs.-subset p_{ij} averages for the PF 1 (sorted by p_{ij} averages; values normalized to ease comparison between spatial and relational distances).*

<i>Subsets</i>	<i>Spatial distance</i>	<i>Average p_{ij} (inhumations)</i>	<i>Average p_{ij} (cremations)</i>
Cerveteri/Gabii	0.428539	0.536482	0
Cerveteri/San Giuliano	0.150294	0.216432	0.038548
Bisenzio/Cerveteri	0.579603	0.366895	0.084431
Cerveteri/Tarquinia	0.295963	0.382972	0.129437
Cerveteri/Roma	0.229856	N/A	0.134891
Gabii/Tarquinia	0.875175	0.221235	0.139593
Cerveteri/Veio	0.093882	0.411719	0.154306
San Giuliano/Tarquinia	0.118214	1	0.155603
Bisenzio/Tarquinia	0.236191	0.678323	0.211271
Roma/Tarquinia	0.692526	N/A	0.211832
Tarquinia/Veio	0.513245	0.45317	0.232913
Gabii/San Giuliano	0.606578	0.184161	0.36879
Roma/Veio	0	0.343974	0.560653
Gabii/Veio	0.167758	0.069671	0.626961
Gabii/Roma	0.007922	N/A	0.645769
Bisenzio/Gabii	1	0.164944	0.64592
Roma/San Giuliano	0.446163	0.643957	0.665891
San Giuliano/Veio	0.253201	N/A	0.715003
Bisenzio/Roma	0.863773	0	0.898584
Bisenzio/Veio	0.670005	N/A	0.972175
Bisenzio/San Giuliano	0.242401	N/A	1

CHAPTER 6: EARLY IRON AGE 2 (PF 2)

Over the course of the PF 2, TCI witnessed further demographic growth, increasing levels of wealth disparity, and the emergence of specialized economic systems. At Tarquinia and perhaps also Gabii and Veio there is evidence for a second stage of settlement concentration, with PF 2 scatters covering slightly smaller surfaces compared to the PF 1. At the same time, the hinterlands of the emerging centers feature larger numbers of settlements and production sites distributed ‘strategically’ in relation to natural resources, major communication routes, and defensible topographic features (e.g., Peroni and di Gennaro 1986; Iaia and Mandolesi 1993).

Compared to the PF 1, however, this phase is not well documented. Cemeteries with large PF 1 components often do not extend into the PF 2 or are attested only on a significantly reduced scale. In the case of many funerary contexts that have yielded large PF 2 samples, only a few burials have been published (e.g., Castel di Decima; Bartoloni, Cataldi Dini, and Zevi 1982; Grotta Gramiccia; Berardinetti and Drago 1997; Casale del Fosso; Buranelli, Drago, and Paolini 1997). Two of the subsets discussed at length in chapter 5—Bisenzio and Cerveteri—are too poorly documented to allow for systematic analysis of PF 2 developments (see Iaia and Mandolesi 1993; Belardelli et al. 2007:27-37, 276-279).

Well studied funerary contexts appear very different from those of the PF 1 (Iaia 1999:126-135; Bietti Sestieri 2010:282-284). Among other developments, the proportion of inhumations within northern TCI datasets steadily increases, so that by the third quarter of the eighth century it appears as the predominant disposal mode across the research area. Assemblages on average encompass a broader range of material culture, including exotica and highly decorated pottery and metal vessels. Disparities in the elaboration of graves and the size and quality of assemblages become more marked. Finally, full-size weapons are encountered more frequently, along with increasingly elaborate panoplies of ‘parade’ armor.

Section 5.1 outlines the evidence from individual subsets (Gabii, Rome, Tarquinia, and Veio).

Sufficiently large datasets to allow for the reconstruction of subset-specific networks are available only for Gabii and Veio. The resulting structural patterns point to different vernacular developments. In the case of Osteria dell'Osa (Gabii), plausible structure is limited to the subphase networks. This may indicate relative discontinuity or at least a high rate of change in the area of Gabii after the period of vernacular homogeneity suggested by the PF 1 network (section 5.1). For Quattro Fontanili (Veio), in contrast, the network based on all PF 2 burials is far more coherent than the subphase networks. Rome and Tarquinia are not associated with large funerary datasets, but the evidence from survey and excavation is more substantial than for the PF 1.

In section 5.2 I present and analyze the aggregate dataset. Even accounting for the lower number of subsets it captures, the PF 2 network appears less densely connected than the PF 1 representations. Increased proximity between Rome and Gabii, on the one hand, and Tarquinia and Veio, on the other, could be interpreted as evidence at last for the differentiation of 'Etruria' and 'Latium', though it is important to note that there is still no clear boundary along the Tiber. In any case, as discussed in chapter 7, systematic comparison with both BF and PF 1 relational patterns does not support conventional models of 'trickle-down Complexity' from north to south.

1. MAJOR SPATIAL SUBSETS

Gabii

Settlement evidence: Especially in light of the density and extent of PF 1 scatters around the Castiglione crater, PF 2 material appears underrepresented in the survey evidence. The disparity between the two periods is evident in peripheral areas and to a lesser extent within the later city walls (Guaitoli 1981:37-38). Unfortunately, excavation data remain scarce, though ongoing work at the site is reaching relevant stratigraphic sequences over a large area. Aside from a rich infant burial (see below), initial results from this work include two trenches cut into the bedrock that are formally consistent with the foundations of well documented PF huts from other TCI sites (Mogetta and Becker 2014:176). Although later construction obliterated much of the stratigraphy pertaining to the use of these potential structures, one of them is associated with abandonment levels that provide a terminus ante quem of the 7th century and include traces of burning.

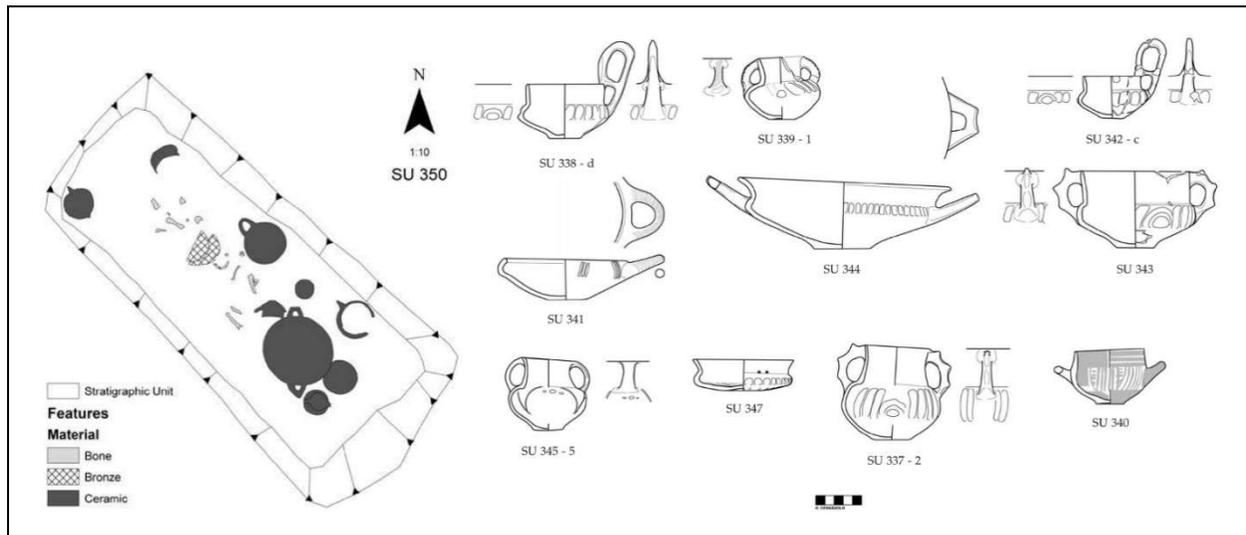
Funerary evidence: The cemetery of Castiglione appears to have been abandoned prior to the beginning of the period. Osteria dell'Osa remained in use, but PF 2 burials make up only a small and in part spatially segregated component of the excavated sample (Bietti Sestieri 1992b:116). Despite the lower number of burials compared to the preceding phase, PF 2 Osteria dell'Osa displays some noteworthy trends (e.g., Bietti Sestieri 1992b:199-206). In the PF 2a-b (Osa IIIA, according to traditional chronologies 770-740/730), although a few burials were situated within earlier groups, the majority were clustered over 30 meters away from the predominantly PF 1 area (group 230-293, close to 30 burials). The end of the period is less well represented (PF 2c/Osa IIIB, 740/730-720). Burials were distributed at most in pairs or groups of three on top of earlier clusters, often with little regard for the integrity of existing graves.

Based on its spatial organization, the excavators argue that the main PF 2a-b cluster corresponds to two or three corporate groups focused around a central male-female pair. The first individual, a male of approximately 60 years, was buried with the earliest functional weapon excavated at the cemetery (a bronze javelin head; note that this individual is presented as male in most discussions based on the accompanying objects; in the original bioarchaeological report, the skeletal remains are identified as female; Becker and Salvadei 1992:149). Observing that in the preceding period representations of martial implements were associated with younger males, the excavators hypothesize a final stage in the ideological shifts discussed in section 5.1. According to this perspective, rather than standing for warrior identity in the context of competing families, by the eighth century weapons would have symbolized the ultimate concentration of decision-making power in the hands of chiefly figures (e.g., Bietti Sestieri 1992b:208). The second individual in the central pair, a female of 15-18 years, represents the latest cremation from the cemetery. Among other objects, the grave included a type of jar that the excavators also interpret as a sign of prestige on the basis of its formal and stylistic development and changing patterns of association with age and sex categories around the PF 1-PF 2 transition (Bietti Sestieri 1992b:132-133).

Males and females are equally attested within the sample as a whole and in both subphases of the PF 2. The most notable demographic anomaly is that infants and children are underrepresented. As mentioned in section 5.1, they were probably buried within settlement areas. For example, recent excavations within the limits of the historical city uncovered an infant burial datable

between the end of the PF 2 and the early 7th century (Becker and Nowlin 2011; Mogetta and Becker 2014:176-177). The grave was located near the foundations of a possible hut and included an extremely rich assemblage of pottery and bronze objects (fig. 6.1).

FIGURE 6.1 *Plan and selection of objects from burial 10, Area A of the Gabii Project excavation site (adapted from Becker and Nowlin 2011:30, fig. 6).*



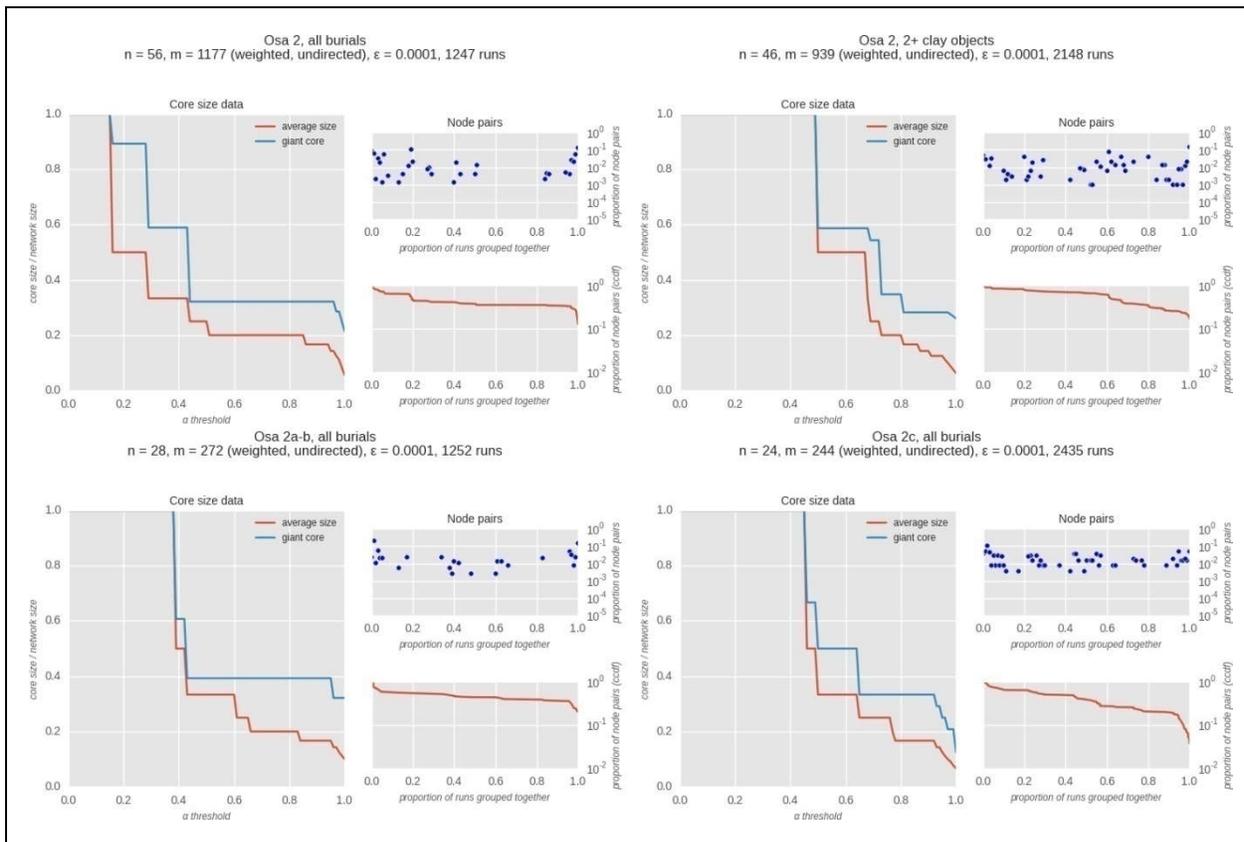
Along with similarly wealthy PF 2 burials from Osteria dell’Osa, this deposition could indicate that some of the families residing at Gabii had access to considerable resources. More generally, average assemblage size increases throughout the period, but in part this change masks polarized distributions at the level of individual burials. Particularly in the PF 2c, some apparently intact burials entirely lack assemblages, while others are associated with dozens of objects.

A total of 56 burials yielded suitable assemblages for network reconstruction. As anticipated in section 2.3, representations based on the entire sample are characterized by anomalous core structure (fig. 6.2; cf. the presentation of expected structural patterns in section 2.3). The network encompassing all burials lacks much of the expected mesoscalar structure (i.e., most node pairs are either seldom or very frequently grouped in the same topological community). Excluding depositions associated with fewer than two clay objects yields marginally better results, but the network is still polarized. More balanced core structure is obtained only by considering the PF 2a-b and PF 2c subphases separately.

With regard to the relationship between network structure and independent variables, due to the limited number of cremations disposal mode is no longer a determining factor. Although

bioarchaeological determinations are available for a majority of burials, there are no significant associations between demographic variables and the large cores at low α thresholds, and core size decreases too rapidly to examine patterns at higher levels systematically. The reduced relevance of demographic variables is not surprising, as the excavators also note a decline in the incidence of object configurations associated with specific age and sex categories between the PF 1 and PF 2 (Bietti Sestieri 1992b:116-117).

FIGURE 6.2 Networks based on the PF 2 sample from Osteria dell'Osa, Gabii (top left: all burials; top right: burials containing at least two objects; bottom left: PF 2a-b, all burials; bottom right: PF 2c, all burials; excluding burials containing fewer than two objects from the subphase networks does not impact core structure).



General observations: The sharp reduction in the extent and density of surface scatters around the Castiglione crater between the PF 1 and PF 2 could reflect a second stage of settlement concentration. Later phases of intensive urban development at Gabii were concentrated within a smaller area than the one covered by PF 1 scatters (Becker, Mogetta, and Terrenato 2009). If population began converging within this area during the PF 2, the associated deposits would have been more susceptible overall to concealment due to later activity, accounting for the inconspicuousness of eighth-century material in the survey data (cf. Guaitoli 1981:39, n. 89).

A reduction in habitation area between the PF 1 and PF 2 has also been noted in northern subsets. At Tarquinia, for instance, the section of the plateau covered by the most substantial PF 1 scatters has yielded only funerary evidence for the PF 2 (see below). In the case of Gabii, however, an analogous process of concentration would be all the more striking considering that settlement density appears to have been relatively high already in the ninth century—though confined to smaller area, PF 1 scatters are comparable in number and extent to those found on the northern plateaus. In fact, PF 1 settlement density at Gabii may have been even higher than suggested by the surface scatters. For example, a report on the survey work points out that excavations east of the crater revealed evidence for the presence of PF huts in an area devoid of pertinent surface material: “Prior to the excavation in this area, which had been explored multiple times [through survey], only rare PF fragments had been found; this fact argues for caution in the interpretation [of the settlement map derived from surface scatters]” (Guaitoli 1981:37, n. 80, my translation).¹² Of course, surface scatters could provide a similarly incomplete picture of settlement patterns in the case of the northern plateaus. Due to the much greater surfaces involved, however, an improbably dramatic demographic jump would have to be invoked to posit dense patterns of habitation already in the PF 1.

As argued in section 3.4, settlement density may prove to be a key variable to account for the purportedly distinct developmental trajectories north and south of the Tiber. Similar processes of demographic growth and conflict could have led to different settlement configurations depending on the character of the underlying topographic features. According to this scenario, which is evaluated in section 7.4, the availability of large but easily defensible plateaus within many northern subsets could have occasioned lower settlement densities than in the south, where features capable of hosting numerically comparable settlements are less clearly demarcated (cf. the ‘anomalous’ northern case of Bisenzio). Defending settlements situated on more open features would have presented significant challenges, which could have been met through proactive mechanisms for gathering, sharing, and acting on information, investment in defensive works, or both, among other strategies. Regardless, the associated costs would have been negatively correlated with the spatial extent of the settlements, providing an incentive for greater concentration early on.

¹² “Prima dello scavo nella zona, più volte esplorata, si erano rinvenuti rarissimi frammenti riferibili all’età del ferro; il fatto induce a procedere con molta prudenza nell’interpretazione della carta [...]”

These observations could account for a more appreciable initial episode of settlement concentration at Gabii compared to many northern subsets, but they raise questions about the nature of a potential second stage of concentration between the PF 1 and PF 2. Greater settlement density may have provided defensive benefits, but if it really attained considerable magnitude early in the PF 1 it is easy to envision how further increases could have encroached on thresholds of sustainability (cf. Kosse 2001). In fact, an excessively rapid or dramatic process of demographic concentration in the PF 1 could have enmeshed long-term instability in the relational fabric of the new center.

On a purely speculative basis, therefore, it is interesting to consider the possibility that the paucity and limited extent of PF 2 material at Gabii might reflect a temporary collapse. As argued in section 5.1, changes in demographic patterns and a substantial drop in the number of burials with clear martial connotations between the PF 1a and PF 1b at Osteria dell'Osa could indicate that levels of conflict peaked right before the potential second-stage concentration event. In the PF 2, in addition to the reduced surface evidence, Castiglione is no longer attested and Osteria dell'Osa is associated with relatively few and anomalously distributed burials. From this perspective, the structural patterns observed for the PF 2 networks appear all the more significant.

Rome

Settlement evidence: Compared to the PF 1, the PF 2 at Rome is associated with slightly better excavation data, though the topography of funerary areas still constitutes the most frequently invoked line of evidence in the debate over the extent of the emerging center (see below). Based on such evidence, most specialists reconstruct a larger, unified settlement covering up to 150 or even 170 hectares (Fulminante 2014:78-79 and references therein).

Work within historically important areas of the later city has documented traces of monumental construction datable as early as the middle of the eighth century. Especially notable are defensive works uncovered at the foot of the Palatine hill, including a possible gate (Carandini 1997:491-493; Carandini and Carafa 2000). Additionally, large earthen-wall structures have been excavated within an area that in the historical period included important public buildings—the Vesta sanctuary and the Regia. Much has been made of the political and ritual significance of

such structures for the character of ‘early Rome’. The wall, for instance, was founded on a leveling layer covering the remains of PF 1 huts, and both its construction and dismantlement within less than a century seem to have been accompanied by the deposition of human remains (discussed below). In combination with evidence from literary sources, it has been argued that these and other characteristics point to “the presence on the Palatine of a new authority, stronger and more centralized than the preceding one (probably a *rex-augur* [sacerdotal ruler]), capable of ordering the local community to undertake such a conspicuous project and ensuring its execution” (Carandini 1997:493, my translation).¹³ In light of such claims, it is interesting to note that analyses of plant remains from associated stratigraphic units point to household-level crop processing during the PF 2, with evidence for increasingly centralized activities only beginning in the following period (Motta 2002 and 2011).

Funerary evidence: Burials of infants and occasionally older individuals appear to have accompanied major construction projects at Rome throughout the eighth and seventh centuries. The deposits linked to the construction of the Palatine wall included an infant burial, and a second infant burial and a handful of adult inhumations interpreted as human sacrifices were found in connection with its destruction in the first half of the 7th century (Carandini 1997:505-506; Carafa 2008). Yet another infant burial marked the second phase of a structure in the area of the later Regia. This grave seems to have been put in place during the expansion of a preexisting building in the third quarter of the eighth century and included a relatively rich assemblage of pottery and ornaments (Filippi 2008:620-621). Additional intra-settlement burials have been documented in connection with the metalworking site on the Capitoline mentioned in section 4.1. Already in the PF 1, this area included inhumations pertaining to three young children and an adolescent of approximately 17 years. Toward the end of the PF 2, two slightly older individuals were interred near one another—a female and male, respectively 16-19 and 17-19 years old (Lugli 2001:313-314). The female burial did not include grave goods, while the male was accompanied by a pot and a javelin head.

Standard funerary areas include few PF 2 burials. A single cremation and 23 inhumations are

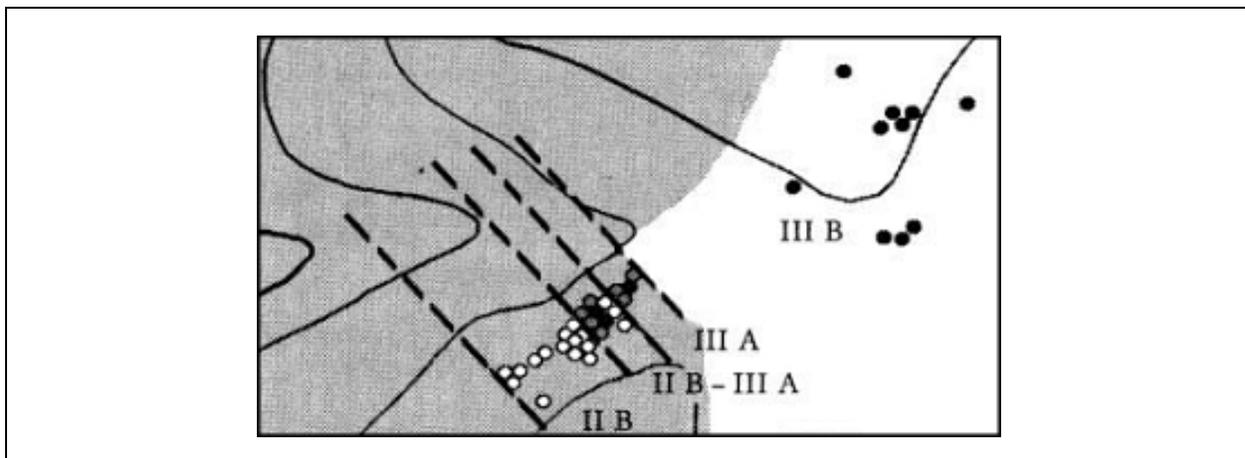
¹³ “Un rimodellamento così drastico e contro tendenza rispetto all’abitato del Septimontium, fino ad allora in espansione, una così importante distruzione di edifici (le capanne), un lavoro pubblico così simbolicamente significativo e originale (siamo in presenza di mura e non di un aggere) ci inducono a ipotizzare la presenza sul Palatino di una nuova autorità, più forte e centralistica della precedente (verosimilmente un *rex-augur*), capace di ordinare e far eseguire un tale cospicuo lavoro alla comunità locale”

associated with suitable assemblages for network reconstruction. In terms of chronology, the early PF 2 is slightly better represented (14 burials for the PF 2a-b, 10 for the PF 2c). No bioarchaeological data are available. Although most of the dataset derives from a single context—the Esquiline cemetery—the subset-specific network representation did not yield core structure.

General observations: The PF 2 occupies a special place in the debate over the development of the historical city. The traces of monumental construction uncovered in the course of recent excavations, in particular, can be dated around the time specified by most literary accounts for the ‘foundation’ of the city. These and other conjunctions with historical evidence are interesting, but it is important to note that the archaeological data from PF Rome are far from unique within TCI. For example, PF Veio supplies especially close parallels in terms of the association between burials and early structures within areas that were subsequently occupied by major public buildings as well as the targeted construction of fortifications (see below and section 5.1).

With regard to the extent of the PF 2 settlement, as already mentioned further shifts in the location of funerary areas have prompted estimates of 150 hectares or more. Between the PF 1b and the end of the PF 2, the major cemetery east of the city, on the Esquiline, seems to have been moved progressively farther away from the heart of the settlement area. Although this observation rests on the location of relatively few burials, it has been used to reconstruct a fine-grained chronology for the gradual expansion of habitation (fig. 6.3).

FIGURE 6.3 *Hypothesized chronological shifts in the location of burials on the Esquiline, Rome (PF 1b in white, PF 2a-b in grey, PF 2c in black; adapted from Motta 2011:112, fig. 24, originally from Carandini 1997).*



Tarquinius

Settlement evidence: Along with Veio, Tarquinia is the only center north of the Tiber for which sufficient information is available to distinguish between PF 1 and PF 2 settlement patterns. The middle of the eighth century is associated with substantial changes (Mandolesi 1999:194-204). Habitation is no longer attested on the Monterozzi hill southwest of the Civita plateau. Within the perimeter of the Civita, there are no traces of habitation from Cretoncini (the northernmost section), which during the PF 1 featured the largest scatters of settlement material (Mandolesi 1999:137-138). Instead, small burial grounds were probably set up along its eastern edge (fig. 6.4). These changes are interpreted as evidence for further demographic concentration on the Civita, presaging the formation of a well delineated urban entity in the seventh and sixth centuries.

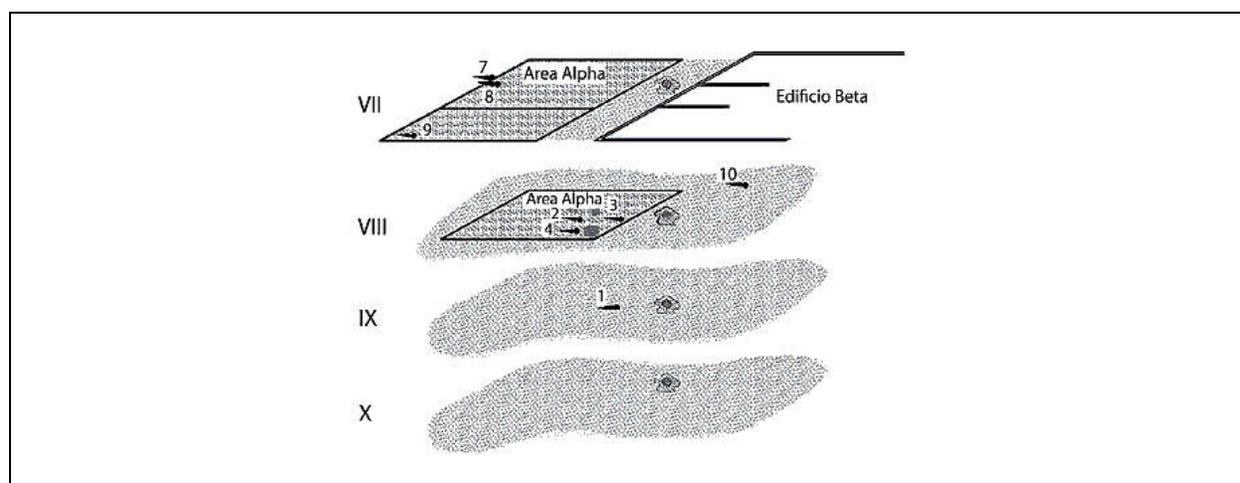
FIGURE 6.4 *PF 2 scatters on the site of the historical city of Tarquinii (triangles indicate traces of small burial clusters; adapted from Mandolesi 1999:139, fig. 63; note that modern Tarquinia does not correspond to the historical city).*



I argued that a similar reduction in the area covered by surface scatters at Gabii could be indicative of a partial collapse. In that case, however, PF 2 data are scarce across all available categories of evidence. At Tarquinia, not only are PF 2 scatters in the southern portion of the plateau just as frequent and often more extensive than in the PF 1, but there is also evidence for the expansion of funerary areas (though they are not as well documented as in the PF 1; see below).

Despite the limited extent of the excavated areas, stratigraphic sequences from the eastern section of the plateau encompass notable PF 2 features. As outlined in section 4.1, the so-called ‘Area Sacra’ in this part of the Civita preserved slight traces of BF activity centered on a natural cavity in the bedrock. The evidence becomes more substantial toward the PF 1-PF 2 transition (Bonghi Jovino 2010:165-168). In addition to two idiosyncratic burials, the eighth century is attested by new plaster floors, pits and postholes pertaining to possible structures and open activity areas, and continued use of a pottery production feature already documented in the BF (fig. 6.5).

FIGURE 6.5 *Development of the ‘Area Sacra’ on the Civita (burials denoted with numbers, approximate dates with Roman numerals, in centuries; the irregular shape present at all levels represents a natural cavity in the bedrock; adapted from Bonghi Jovino 2010:165, fig. 4).*



Funerary evidence: Between the end of the ninth and beginning of the eighth centuries, a male child of about eight years was buried close to the bedrock feature along with a large number of deer antler fragments and a bronze pendant and pin (n. 1 in fig. 6.5). The remains present anomalies linked to epilepsy and other conditions that in the historical period carried religious connotations (Fornaciari and Mallegni 1987; Bonghi Jovino 2009).

Around the middle of the century, an adult male of 30-35 years was buried on the other side of the cavity from the child (n. 10 in fig. 6.5). Material culture within the grave was limited to fragments of a Euboean-style Aegean jug in the area of the chest and mixed with the fill. Bioarchaeological analyses suggest that the individual was not local, spent a significant amount of time at sea, and was killed by a blow to the head (Mallegni and Lippi 2008). In light of this evidence, as well as the fact that Euboean-style pottery is found in some of the earliest ‘colonial’

contexts in southern Italy, it has been hypothesized that this burial belonged to an Aegean sailor sacrificed “because he had broken a religious rule” (Bonghi Jovino 2010:166). Potentially anomalous funerary depositions are also attested right after the PF 2, including another child of around eight years who appears to have been beheaded (Mallegni and Lippi 2008).

In terms of more conventional funerary evidence, the PF 2 in the area of Tarquinia is not well documented (especially the latter part of the period; Iaia 1999:20). The funerary areas that seem to have replaced habitation on the Cretoncini have not been excavated. Beyond the Civita, the cessation of settlement in the Monterozzi area involved the abandonment of several burial grounds that supplied large PF 1 samples. A notable exception is Arcatelle, which began expanding and later became the principal cemetery of the historical city. The available data point to trends consistent with those attested at Veio, which is associated with far better evidence. The proportion of inhumations within the sample increases steadily (though perhaps more gradually than elsewhere in the north; Delpino 1995). Disparities in mortuary treatment are also much more widely attested, with some individuals interred in plain graves containing just a few items and others in elaborate enclosures along with objects such as wheel-thrown pottery, metal vessels, jewelry, and richly decorated bronze shields, helmets, and belts.

The majority of burials associated with suitable assemblages for network reconstruction were excavated at Arcatelle on Monterozzi and Selciatello di Sopra to the east of the Civita (cf. fig. 5.8). The dataset includes 16 cremations and 5 inhumations. No bioarchaeological data are available, and the subset-specific network did not yield core structure.

General observations: Citing the peculiar burials, possible votive deposits, and evidence for monumental construction around the bedrock cavity immediately following the PF 2, the excavators of the ‘Area Sacra’ reconstruct a long-lived sacred precinct tied to the development of civic identity and state institutions on the Civita (Bonghi Jovino and Chiaramonte Treré 1997). Ultimately, this interpretation is woven into a broader narrative centered on the impact of the ‘Greek’ advent on local systems:

It is safe to assume that at this time, the community was organized around a central power, since that would have supported the move from wooden to stone construction in the Area Sacra. This means that the original community was evolving into a so-called community-state. Such a state would have been organized according to a class-based hierarchy, which

would perhaps have been more appealing to a people with a growing prestige and expanding hegemony in the area. At this time, for example, Tarquinia developed more intense contacts with the Greeks [...] (Bonghi Jovino 2010:167)

As argued in section 4.1, the ‘votive’ deposits and hearths that characterize the ‘Area Sacra’ could very well have resulted from productive activities. Much like in the case of Rome (as well as Veio, see below), it seems problematic to allow later monumental developments to color the interpretation of PF sites. That is not to say that the ‘Area Sacra’ was not ideologically important in subsequent phases. In fact, the seventh- and sixth-century evidence for ritual activity organized around the bedrock cavity is substantial and plausible (cf. Terrenato 2000). By that time, however, especially considering the convergence of groups from different communities within the new centers, recognizably earlier burials and other traces of activity may have been ripe for reinterpretation in terms of common origin and identity.

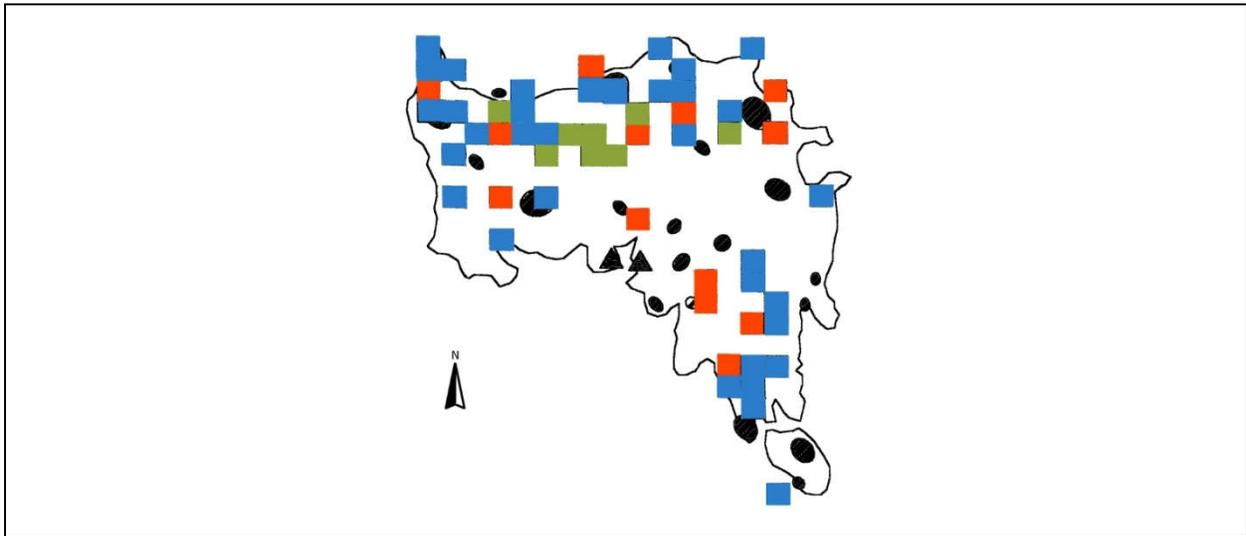
Veio

Settlement evidence: Owing to a new analysis of PF materials from the extensive South Etruria Survey, it is partially possible to distinguish patterns of occupation in the area of the plateau by subphase (fig. 6.6; di Gennaro and Schiappelli 2012; for the original survey, see Ward-Perkins 1961). Several PF 1 scatters around the center of the plateau are no longer attested in the PF 2. As with Gabii and Tarquinia, the reduced extent of scatters may be indicative of a second stage of settlement concentration, though in this case it has been noted that PF 1 material on the whole was more diagnostic (Schiappelli 2012:334).

Within the northwestern sector of the plateau (Campetti site), the PF 2 was marked by the erection of a new system of defensive works. The northern edge of this sector, which was not as naturally protected as the rest of the site, had already been shored up in the BF (cf. section 4.1). A simple rampart was maintained during the PF 1, but the first half of the eighth century saw the construction of a more sophisticated earth and rock system that remained in use down to the first half of the sixth century (Bartoloni et al. 2013:138). Monumental projects were also carried out in the southernmost sector of the plateau (Piazza d’Armi). In the second half of the eighth century, the oval hut that enclosed the plain male inhumation described section 5.1 was replaced with a more permanent rectangular structure. An even more substantial building with a stone base and a terracotta roof followed shortly after the close of the PF 2, when the surrounding area

also presents evidence for an orthogonal road layout, a large water cistern, and ‘aristocratic’ residences (Bartoloni et al. 2013).

FIGURE 6.6 *PF subphase scatters on the site of the historical city of Veii (PF 1 in orange, PF 2 in green, both/generic PF in blue; squares are 100 meters on a side and pertain to material derived from the original South Etruria Survey; triangles and irregular markings indicate generic PF material uncovered by other research efforts; cf. fig. 4.12; adapted from Schiappelli 2012:335, figs. 6.5 and 6.8).*

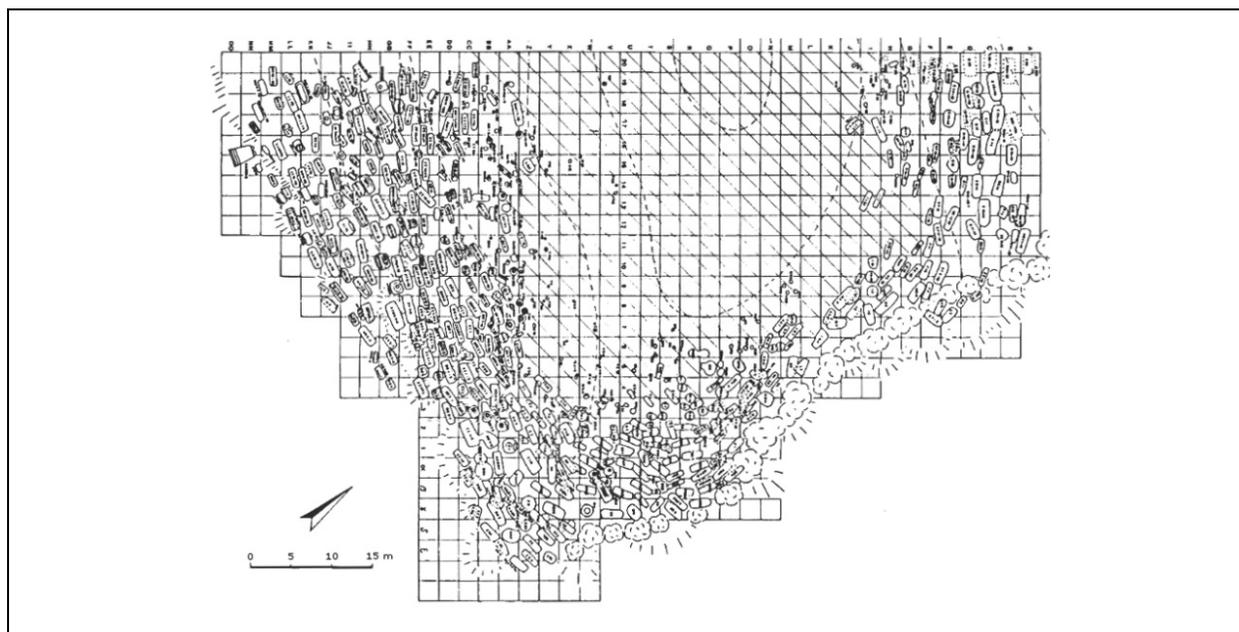


Funerary evidence: The cemetery of Quattro Fontanili has yielded by far the largest sample of PF 2 burials from TCI. Fortunately, this context was excavated with care between 1960 and 1972 and fully published by 1976 (De Agostino et al. 1963, followed by reports in the same journal in 1965, 1967, 1970, 1972, 1975, and 1976). A large proportion of the cemetery, including most PF 1 graves, had been badly damaged by agricultural work prior to the excavation, but reliable information is available for 633 burials (217 cremations and 416 inhumations).

The chronology of Quattro Fontanili has been studied repeatedly, and there is broad agreement regarding the outlines of the sequence (e.g., Toms 1986; Guidi 1993). The sample can be subdivided into three main components (Guidi 1993:99-100): IIA (800/790-760), IIB (760-730), and IIC (730-720). Subphase IIA partially overlaps with the PF 1b at Osa. As illustrated below, however, Quattro Fontanili IIA-C burials make up a structurally coherent network, and for the purposes of comparative analysis there is precedent for lumping them together as a predominantly PF 2 sample (Pacciarelli 2001:261). Accordingly, in the discussion below these three subphases are presented respectively as PF 2a, PF 2b, and PF 2c.

The cemetery displays no clear spatial clusters (fig. 6.7). PF 1 graves likely occupied the top of the Quattro Fontanili hill, which was heavily disturbed by plowing. During the PF 2, the cemetery expanded along the slopes of the hill (Toms 1986:72-73). There have been several attempts to distinguish family groups and areas with higher concentrations of presumed status markers (e.g., Bartoloni 1984; Pacciarelli 2001:271), though none as systematic as the one carried out for Osteria dell’Osa.

FIGURE 6.7 *Plan of the cemetery of Quattro Fontanili, Veio (area devoid of burials had been heavily disturbed by agricultural work; adapted from Guidi 1993:71, fig. 27).*



Over the course of the eighth century, assemblage composition becomes more varied and disparities in the number and quality of objects commonplace. Weapons, though far from frequent, are attested in several burials. The distribution of martial implements and other scarce items—primarily ornaments and metal objects such as distaffs and richly decorated vessels—has been used to reconstruct three levels of social ‘prestige’, each represented by individuals of both sexes and all age categories (Pacciarelli 2001:261-276 and 2010:30-33; cf. Berardinetti, De Santis, and Drago 1997:330). As in the case of Osteria dell’Osa, this trend of increasing inequality and differentiation is interpreted in terms of competition among family groups accompanied by political centralization: “[these] forms of ostentation of rank and wealth [...] can be seen as the outcome of competition and the differential accumulation of goods by different family groups, and also the concentration of authority, wealth, and power in the hands of heads

of the extended families” (Pacciarelli 2001:283).

A total of 160 dated burials are associated with suitable assemblages for network reconstruction (127 inhumations, 33 cremations). Although the dataset is skewed toward the early PF 2, it still includes a large number of burials from the PF 2c (PF 2a: 64 burials; PF 2b: 60; PF 2c: 36). The published reports address state of preservation explicitly for many burials. As discussed in section 4.1, PF 1 burials containing fewer than two clay objects consistently turn out to be damaged. Although the association is not statistically significant for the PF 2, coherent core structure is obtained only by excluding such burials (fig. 6.8).

Contrary to the patterns observed for PF 2 Osteria dell’Osa, breaking up the sample by subphase yields less coherent network structure. In the case of the PF 2c, in particular, representations based on all burials and only those including two or more objects both lack core structure. Bioarchaeological determinations of age and sex are only available for a small proportion of the sample (1963, 1965, and 1970 reports; Passarello 1973). Major age categories are represented as expected, while the sex ratio is slightly skewed toward females (cf. Pacciarelli 2001:62-63, fig. 139). At least based on the available data, there are no significant associations between core composition and age and sex categories. Similarly, despite the presence of a relatively high number of cremations for the PF 2, there seems to be no relationship between disposal mode and network structure until high thresholds.

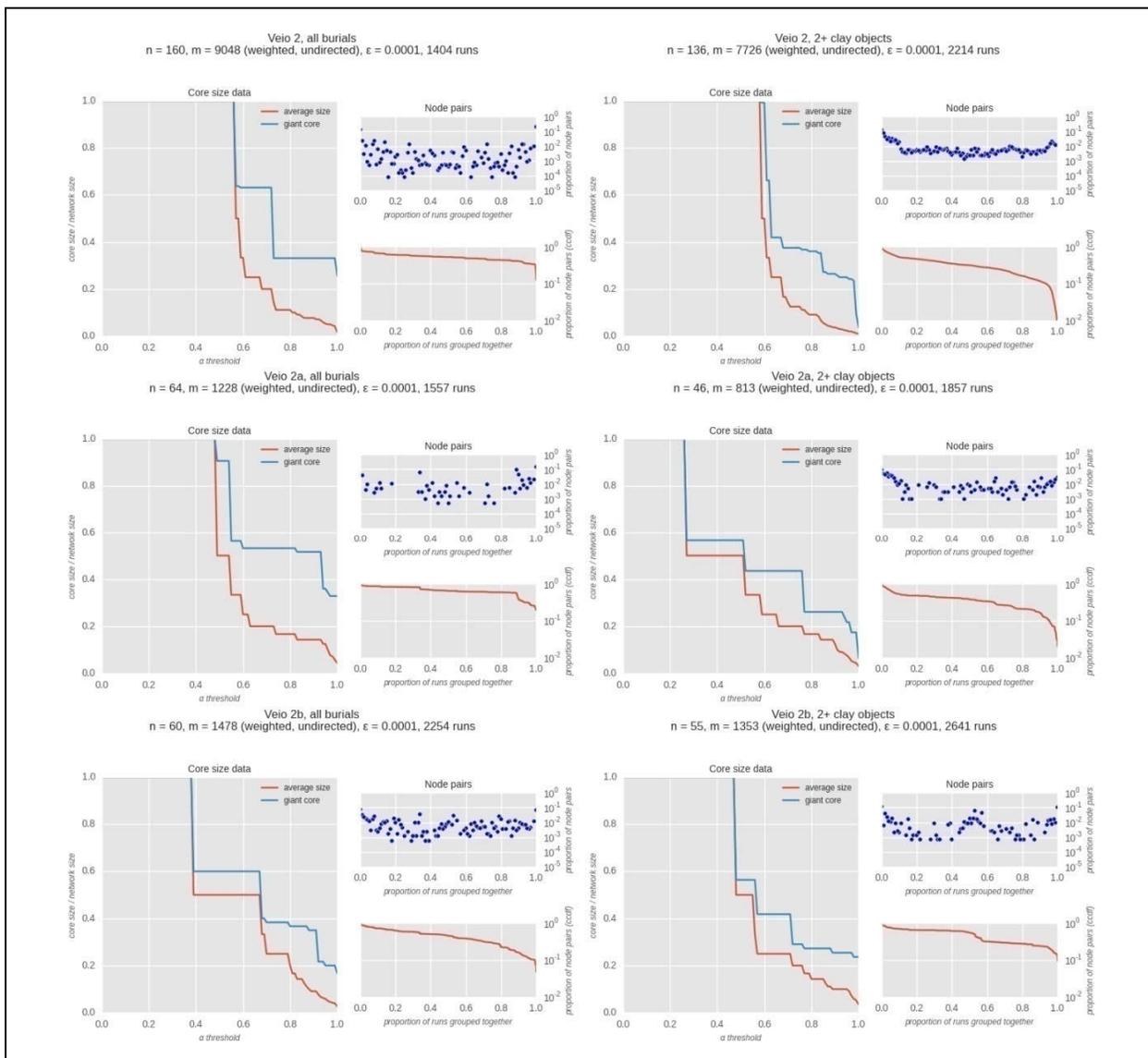
General observations: In light of the PF 2 and later development of the area, which also included the deposition of a second plain inhumation, the individual buried within the the PF 1 hut at Piazza d’Armi has been tentatively identified as a founder of sorts: “[This individual] is not buried along with the rest of the community outside of the settlement area, but rather becomes a catalyst for its development” (Acconcia and Bartoloni 2014:279, my translation; the second burial belonged to a male of 12-18 years; Acconcia and Bartoloni 2014:280).¹⁴ The ideological importance of such burials in the PF, if any, is hard to gauge based on the available evidence. The only observation that seems warranted is that they may not have been all that exceptional.

As demonstrated by PF 1 Tarquinia, TCI mortuary practices were probably much more varied

¹⁴ “Il defunto non è sepolto insieme al resto della comunità all’esterno dell’area insediativa, ma diviene un elemento catalizzatore dello sviluppo di quest’ultima”

than indicated by depositions that survived more or less intact and were well documented. In the context of early excavation efforts, for instance, relatively plain inhumations of the sort excavated at both ends of the plateau at Veio and in the ‘Area Sacra’ at Tarquinia may not have been recognized as potentially significant for the PF (or at all recorded, for that matter). Additionally, the idea that adolescents and adults were rarely buried in settlements does not seem well founded even for later periods (e.g., adult burials of the late 6th-early 5th century have been excavated within the urban area of Gabii; Mogetta and Becker 2014:178; for the relative frequency of intra-settlement burials in the PF, see Vanzetti 2008).

FIGURE 6.8 Networks based on the PF 2 sample from Quattro Fontanili, Veio (top: all burials; bottom: burials containing at least two objects; from left to right, PF 2 as a whole, PF 2a, and PF 2b; representations of the PF 2c did not yield core structure).



2. BASE FOR RELATIONAL RECONSTRUCTION

The aggregate sample for the PF 2 comprises 228 assemblages containing two or more clay objects. Like the PF 1 representation, the resulting network remains cohesive until high α thresholds, but it appears more articulated after the initial break (fig. 6.9). A branch made up predominantly of loosely connected burials from Veio becomes isolated at 0.63 and fades gradually over higher thresholds (core 0.63-0, 54 burials total; Veio: 42 burials, residual of 3.108; core 0.99-1, 42 burials total; Veio: 33 burials, residual of 2.767). The determining assemblage feature for this branch is the presence of multiple bowls ('scodelle'). Pairs of such objects are especially frequent (residuals of 6.668 for one instance, 7.313 for pairs, and 5.772 for three occurrences). Many variants of scodelle are attested even within single cemeteries (for Quattro Fontanili, see Guidi 1993:85, 87, 91), but on the whole this form is less ambiguous than the shoulder-handled jugs discussed in section 5.2. Despite being anchored on a single object type, therefore, the initial break of the network seems well founded.

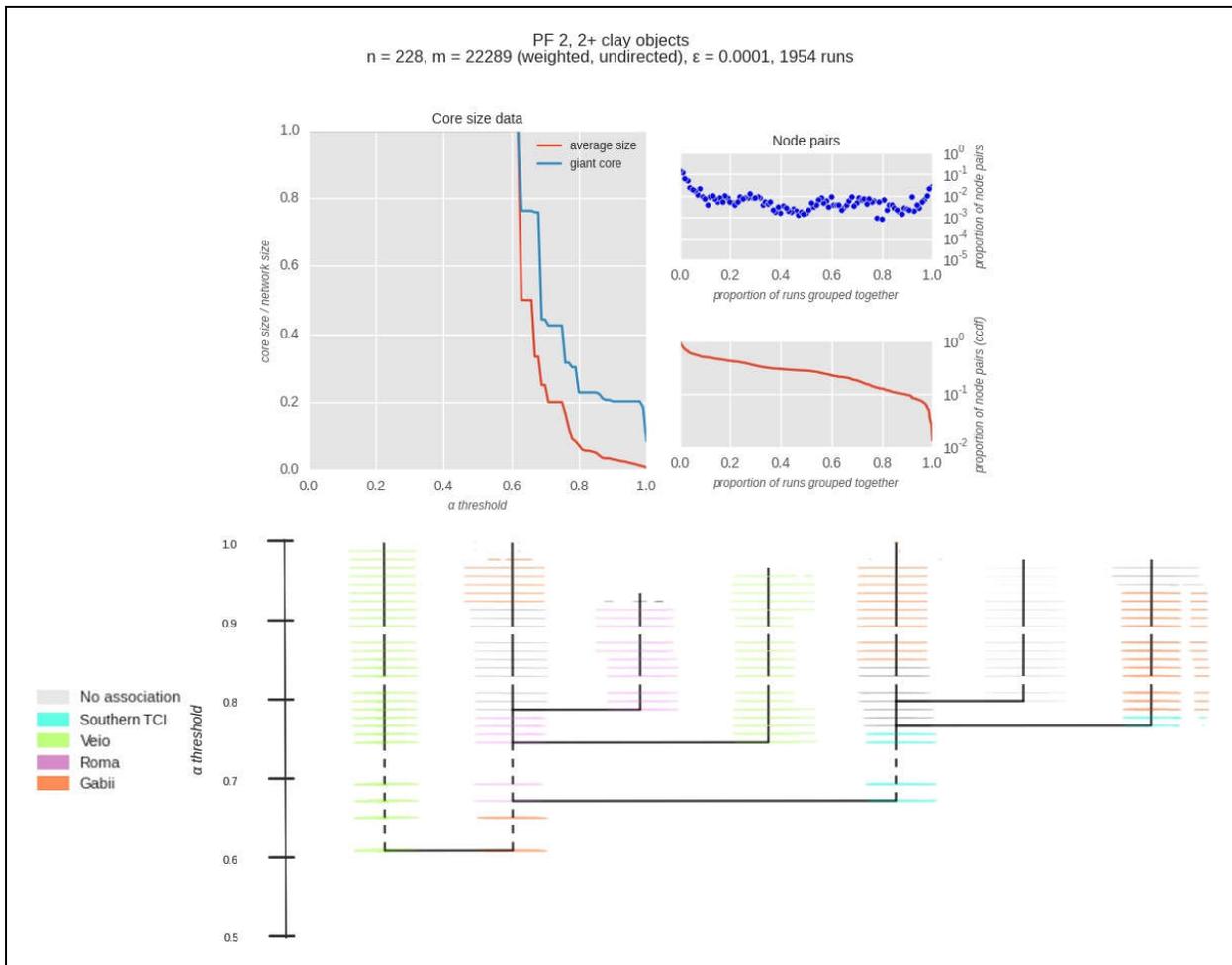
Two major branching events occur at higher thresholds. A diverse core characterized by complex assemblages emerges at 0.69. The assemblage anchors in this case are single instances of double-handled jugs ('amphorae', with a residual of 8.892). Although double-handled jugs are especially well attested in the second half of the eighth century, their prominence within this core results in large part from their co-occurrence with other forms (e.g., amphora plus one or two cups; residuals of 9.697 and 8.050, respectively). As a result, this split is not chronologically significant.

The heterogeneity of cores within most branches of the network reflects the reduced impact of the cremation-inhumation divide that shaped the PF 1 representation. Disposal mode only becomes a significant determinant at a threshold of 0.91. With few exceptions, by that point cores are composed of just a handful of burials. Nevertheless, other non-spatial factors are in play and begin affecting core composition relatively early.

At a threshold of 0.76, another major split segregates 27 burials characterized by various combinations of spindle whorls and bobbins (residuals of 3.843 and 8.496 for single instances of spindle whorls and bobbins, respectively). Judging from the limited dataset of bioarchaeological determinations available for the entire PF sample, such objects tend to occur almost exclusively

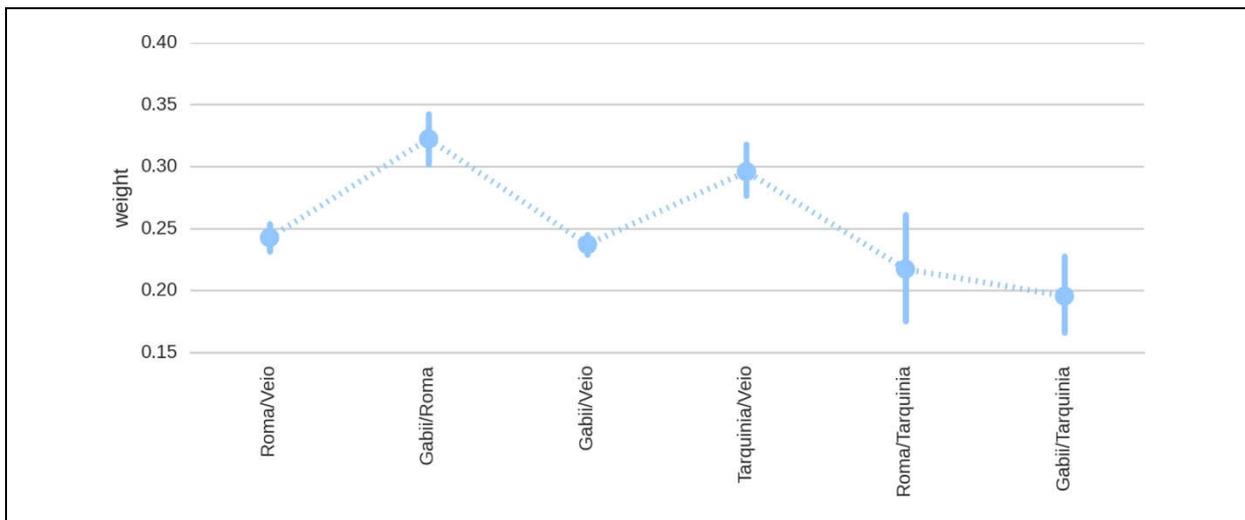
within female burials. Although most of the burials in the resulting core are from Veio, the association is not statistically significant, and Gabii and Rome are also represented as expected. As mentioned in the preceding section, bioarchaeological data are not available for the latter. At Osteria dell’Osa males and females are evenly attested, while in terms of age categories infants and children are encountered less frequently than expected. At Quattro Fontanili, the distribution of age categories appears more balanced, while the sex ratio is skewed toward females (but note that bioarchaeological determinations are available for less than half of the sample; cf. Pacciarelli 2001:62-63, fig. 139). Differences in the demographic profiles of the various subsets may thus play a role in shaping core composition at high thresholds. On the whole, however, the effect of non-spatial variables seems minor.

FIGURE 6.9 PF 2 aggregate network (burials associated with two or more objects; bottom: major branching events and core-spatial subset statistical associations; color opacity corresponds to the magnitude of adjusted residuals, with gray indicating values between zero and two; ‘Southern TCI’ collects sporadic burials from multiple southern TCI contexts).



Average p_{ij} values allow for some interesting observations (fig. 6.10). Viewed independently of the patterns observed for the PF 1, the PF 2 relational landscape suggests a sharp divide between northern and southern TCI. Relational affinities between northern and southern subsets decline as a function of increasing spatial distance, though the slope is much gentler than might be expected given the greater proximity of Veio to Gabii and Rome versus Tarquinia. In the case of the Gabii/Rome and Tarquinia/Veio comparisons, in contrast, spatial distance seems irrelevant.

FIGURE 6.10 *Averages of site vs. site p_{ij} distributions for the PF 2 (sorted by spatial distance; the dashed lines are provided to facilitate comparison; vertical bars indicate 95 percent bootstrap confidence intervals for each average).*



This divide becomes all the more evident when a network derived from the normalized averages is visualized on the TCI map (fig. 6.11; numerical data listed in table 6.1 at the end of the chapter). Though far from trivial in their own right, the Rome/Veio and Gabii/Veio connections are overshadowed by the strong long-distance link between Tarquinia and Veio. Taken at face value, these relational trends could suggest that the system of parallel inland and maritime circuits hypothesized on the basis of the PF 1 cremation network had largely dissolved by the PF 2, but the situation may have been more complicated.

To begin with, it is important to underscore the potential impact of the missing data from Bisenzio, San Giuliano, and Cerveteri. In the PF 1, or at least the early horizon likely captured by the cremations, Bisenzio is largely responsible for drawing Gabii, Rome, and Veio away from Tarquinia, with which they also have strong ties, and by extension Cerveteri. The lack of systematic studies of the Bisenzio evidence from the full PF 2 is especially regrettable, as

impressionistic analyses indicate that its inclusion could have been as determining as for the PF 1. The few reliably published burials encompass eclectic assemblages with parallels to Veio and southern TCI in addition to the traditionally recognized stylistic ties with Tarquinia (e.g., Delpino 1977:483-487). Burial 8 from the Olmo Bello cemetery, for instance, stands out in this regard for the combination of forms such as the orciolo and amphora, which are well attested in the south, along with objects more frequently encountered in the north (fig. 6.12).

FIGURE 6.11 *PF 2 relational patterns derived from average p_{ij} values (edge thickness corresponds to normalized averages listed in table 6.1; node and edge colors reflect topological communities, with inter-community edges in grey; circular layout provided on the bottom left for reference).*

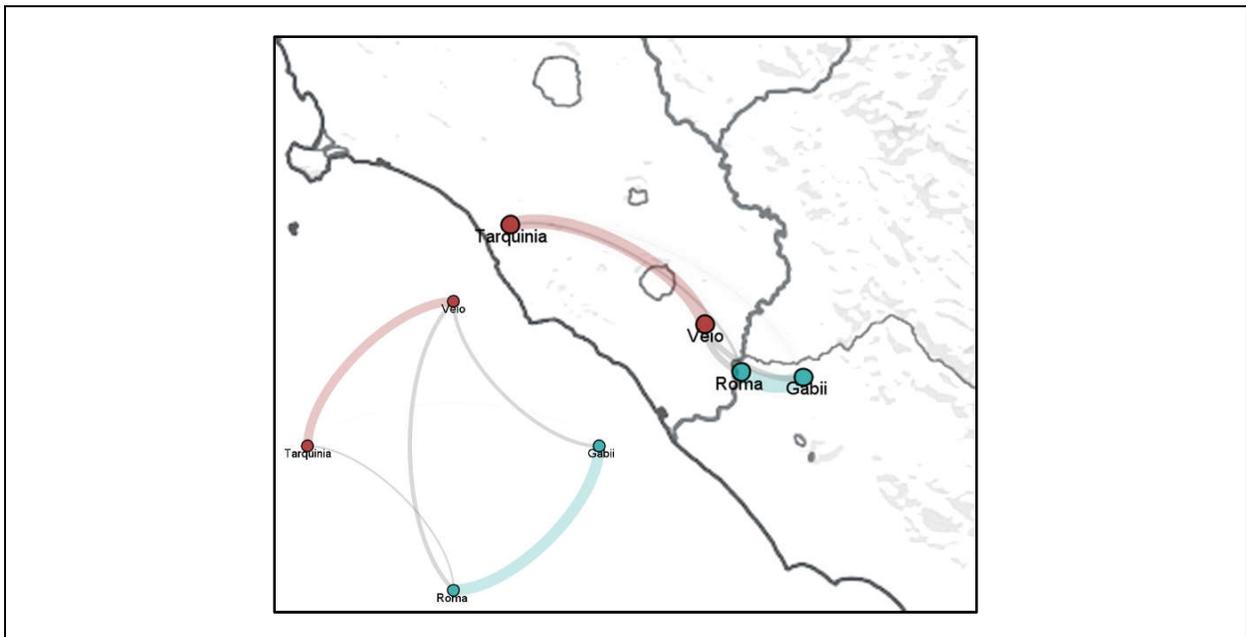
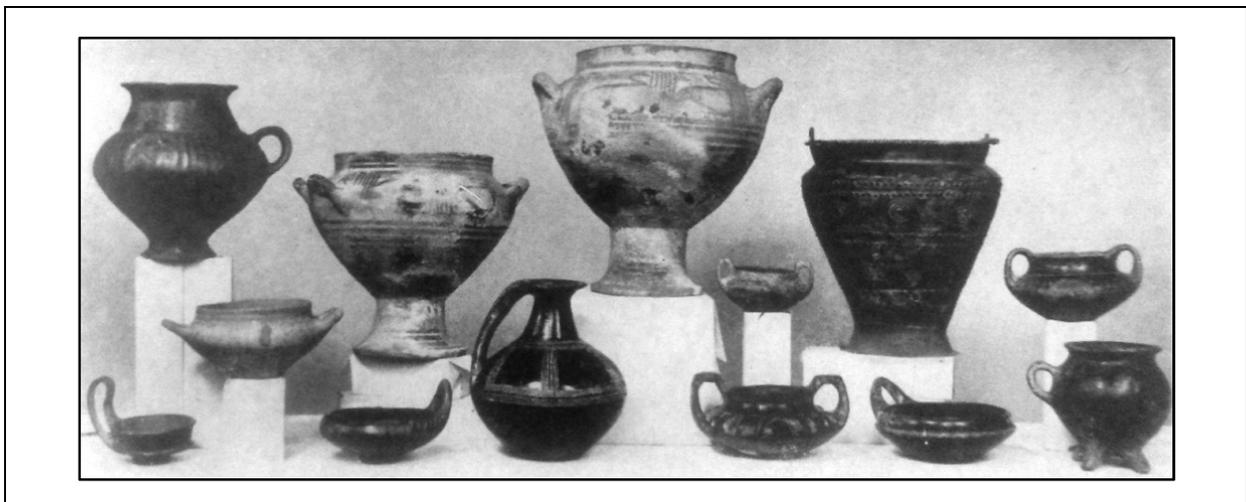


FIGURE 6.12 *Vessels from burial 8, Olmo Bello cemetery, PF 2 (adapted from Delpino 1977, plate 13a). Note the orciolo on the top left and the three amphorae on the bottom right.*



In any case, rather than diminishing in importance, the inland circuit may have attracted Tarquinia into its fold—compared to the PF 1, relational affinities increase between Tarquinia and each of the other represented subsets. Transitioning fully into the realm of speculation, the magnitude of this development may have decreased exponentially in inverse relation to spatial distance, with Veio emerging as a mediator of sorts for the integration of Tarquinia as a full participant in the inland circuit. In turn, this could have tipped the relative balance of affinities between Gabii, Rome, and Veio. These shifts might represent the very beginnings of the dynamics underlying the historical distinction between ‘Etruria’ and ‘Latium’, but even so no clear boundaries can be detected for the PF 2.

TABLE 6.1 *Spatial distances and subset-vs.-subset p_{ij} averages for the PF 2 (sorted by p_{ij} averages; normalized to ease comparison between spatial and relational distances).*

<i>Subsets</i>	<i>Spatial distance</i>	<i>Average p_{ij}</i>
Gabii/Tarquinoa	1	0
Roma/Tarquinoa	0.791301	0.17189
Gabii/Veio	0.191685	0.327917
Roma/Veio	0	0.372021
Tarquinoa/Veio	0.586448	0.791736
Gabii/Roma	0.009052	1

CHAPTER 7: VERNACULAR SUBSTANCE

The last three chapters reviewed the evidence from major spatial subsets of TCI and outlined relational patterns derived from phase-specific networks of mortuary vernaculars. Although I touched on parallels and divergences between these patterns and current interpretations of changes in settlement and mortuary trends, I tried to divorce the process of network reconstruction and analysis and the presentation of the results from the specific expectations outlined in chapter 3. Here I use the reconstructed networks to evaluate those expectations in detail.

Section 7.1 presents the results of the preliminary study of late-PF mobility patterns based on isotopic analyses of human remains. I show that local ranges can be tentatively identified for both the Gabii and Veio subsets and that the sampled cemeteries include surprising proportions of nonlocals. I then compare the relational averages associated with the burials of locals versus nonlocals. As expected, the former appear more entrenched in their respective communities, suggesting that it may be appropriate to treat summary measures extracted from the reconstructed networks as indicators of relative relational proximity. On the strength of these encouraging results, I proceed to tackle major components of existing models.

Section 7.2 considers differences between the distributions of intra- versus inter-subset p_{ij} averages for each phase in order to assess the character of the BF-PF settlement reconfiguration. In contrast with the idea that pre-existing ‘political leagues’ coalesced to form the new centers, the results point to a spatially noisy, undirected process. Moving to the impact of changing axes of long-distance exchange on developmental trajectories, vernacular relational trends suggest that the north-south routes hypothesized for the later PF 1 and PF 2 may represent vestigial traces of the inter-subset relational ‘spike’ associated with the process of settlement reconfiguration (section 7.3).

Both of these observations raise serious doubts concerning the notion of smaller-scale, delayed

processes within southern TCI. Accordingly, it is important to evaluate whether southern centers really hosted much smaller populations than their northern counterparts. Section 7.4 considers the demographic implications of the available settlement evidence and the relationship between measures of intra-subset affinity and the spatial extent of the PF 1 centers. Based on this evidence, I argue that the BF-PF reconfiguration may have resulted in substantially similar social collectives on both sides of the Tiber.

1. PILOT STUDY OF MOBILITY PATTERNS

Section 3.1 introduced average p_{ij} values as a key measure of vernacular affinity. The possibility that this and derivative measures may capture aspects of actual interaction patterns is bolstered by the relative structural coherence of the reconstructed networks (cf. section 2.4 and chapters 4-6). Before analyzing diachronic relational trends in detail, however, it is important to validate the significance of p_{ij} averages on the basis of potentially more direct indicators of interaction patterns. In this section I compare intra-subset averages associated with large samples of late-PF burials to preliminary isotopic determinations of geographical origin for the interred individuals. The isotopic data are derived from the important cemeteries of Quattro Fontanili and Osteria dell'Osa, which belong respectively to the Veio and Gabii subsets. I begin with summaries of the evidence and the characteristics of the analyzed samples from each cemetery.

Quattro Fontanili has yielded over 600 burials, including 416 inhumations from the late PF 1 and PF 2. Despite Veio's supposed transformation into an interregional hub around this time (see below and section 3.3), no clear discontinuities between the two phases or within the latter are evident in the topographic development of the cemetery or changes in the number of interments over time. The structural plausibility of the Veio networks presented in section 6.1 also points to relative stability—the network derived from all PF 2 burials is characterized by a more coherent distribution of p_{ij} values than the subphase networks.

Although many of the inhumations yielded suitable remains for isotopic analysis, I was able to access only a collection of especially well preserved teeth held at Professor Alfredo Coppa's laboratory at the Sapienza University in Rome. Fortunately, this collection represents a large and varied subset of late burials from the cemetery. I obtained samples from 46 adolescents and

adults, representing approximately 12 percent of all PF 1b2-PF 2 burials excavated at the site. Whenever possible, I selected first or second molars, the enamel of which forms early in childhood, otherwise third molars or canines (for a recent reevaluation of enamel formation times in humans, see Read and Dean 2006). Provided that individuals for the most part consumed locally sourced food and there were measurable isotopic differences between the territories of the settlements under consideration, ratios of $^{87}\text{Sr}/^{86}\text{Sr}$ derived from dental enamel can be used to identify individuals who relocated to the community associated with their place of burial after the formation of the sampled tooth (see Montgomery 2010 for a discussion of conditions underlying such analyses and section 2.4 for the suitability of TCI in terms of subsistence patterns and geological variability). After cleaning the teeth, 5-10 mg of enamel powder was extracted from the side of the crowns using a precision drill (cf. Price et al. 2015). The samples were then analyzed by specialists at the Geochemistry Laboratory of the University of North Carolina at Chapel Hill.

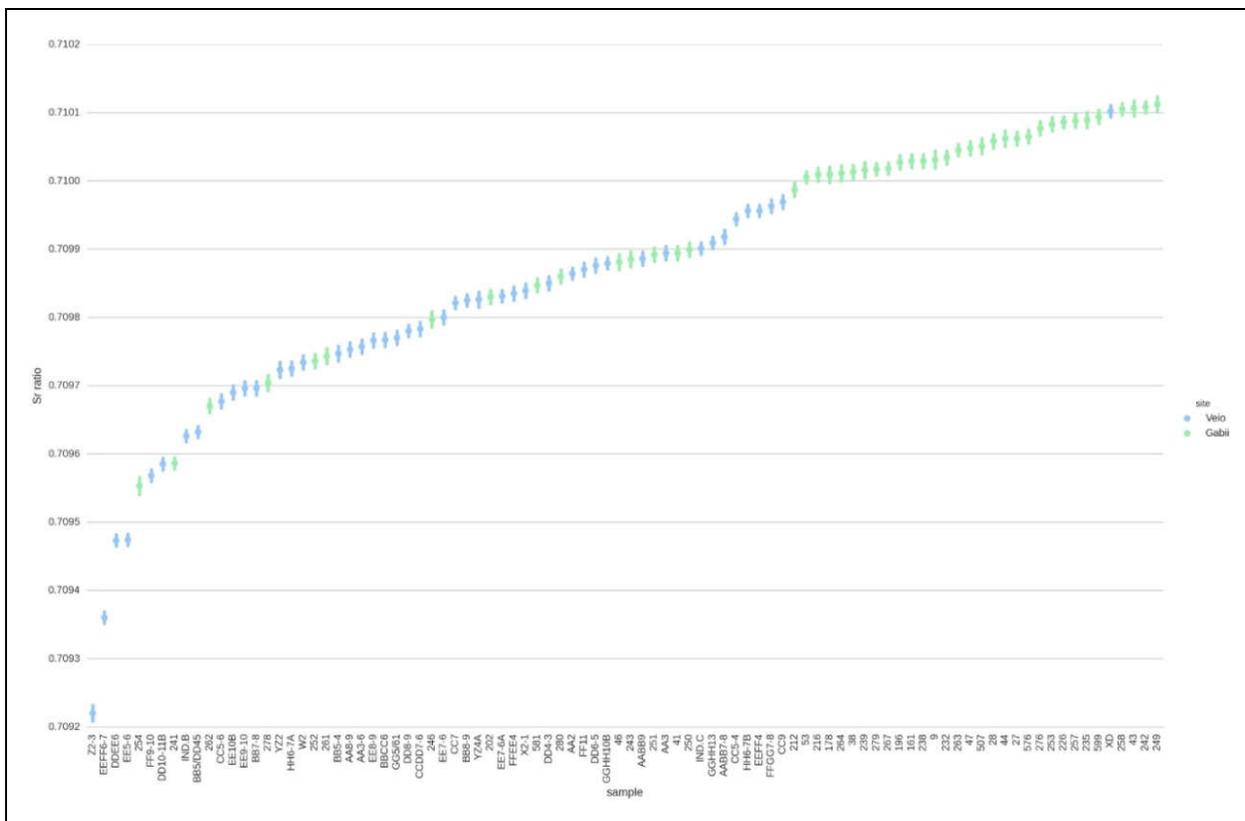
In contrast with Quattro Fontanili, changes in the distribution and number of burials at Osteria dell'Osa suggest a clear break between the end of the PF 1 and the PF 2. With the exception of an uncharacteristically long-lived group located in the PF 1 area of the cemetery (group 1-60; Bietti Sestieri 1992b:194-198), late burials are either concentrated in a small cluster some distance to the south or superimposed haphazardly on earlier groups. Additionally, the number of interments drops substantially, so that it has even been hypothesized that the early PF 2 cluster may pertain to a single extended family or clan. Further evidence for discontinuity is provided by the nearby cemetery of Castiglione, which seems to have been completely abandoned by the end of the PF 1, and perhaps the relative scarcity of PF 2 material within the survey data from the settlement area. Consistent with these observations and again in contrast with Veio, the subphase networks presented in section 6.1 display more coherent structure than the one based on all PF 2 burials.

Despite the reduced level of activity compared to earlier phases, some 122 PF 1b2-PF 2 burials were documented at Osteria dell'Osa over the course of a large-scale excavation project. I was granted access to a total of 57 individuals, which were sampled following the same procedures outlined for Quattro Fontanili. As anticipated in section 2.4, due to unforeseen circumstances at the laboratory undertaking the analyses, only 46 samples have been analyzed. Still, these data

cover approximately 38 percent of the late-PF burials from the site.

In order to create a detailed base map of local signatures, I also collected 28 samples from pig and rodent teeth excavated from 8th-5th century stratigraphic units at or near Cerveteri, Gabii, Rome, and Veio. Comparing the results for the human samples to the local ranges given by the presumably more static fauna could have allowed for precise determinations of geographical origin for nonlocals. Unfortunately, as a result of the aforementioned delays at the laboratory, I have not yet received results from a sufficient number of faunal samples. Even based on the data from the two cemeteries, however, it seems possible to distinguish between locals and nonlocals (fig. 7.1).

FIGURE 7.1 $^{87}\text{Sr}/^{86}\text{Sr}$ results from the cemeteries of Quattro Fontanili and Osteria dell'Osa (Veio and Gabii subsets, respectively; each site is represented by 46 PF 1b2 and PF 2 inhumations; vertical bars indicate 2σ error; values relative to standard of 0.710265 ± 0.000022 ; a detailed breakdown of data for samples associated with suitable burials for network reconstruction is provided in table 7.2 at the end of the chapter).



When the results are plotted in increasing order, most of the values associated with Quattro Fontanili burials form a continuous sequence between 0.7096 and just below 0.7100, while the ones from Osteria dell'Osa largely fall between the latter limit and 0.7102. These thresholds

correspond roughly to local ranges hypothesized based on recent geomorphological work (currently being prepared for publication; Laura Motta, personal communication). Individuals associated with values close to the thresholds may be may be misidentified, of course, but at least provisionally it seems reasonable to use these limits to identify locals and nonlocals at each site.

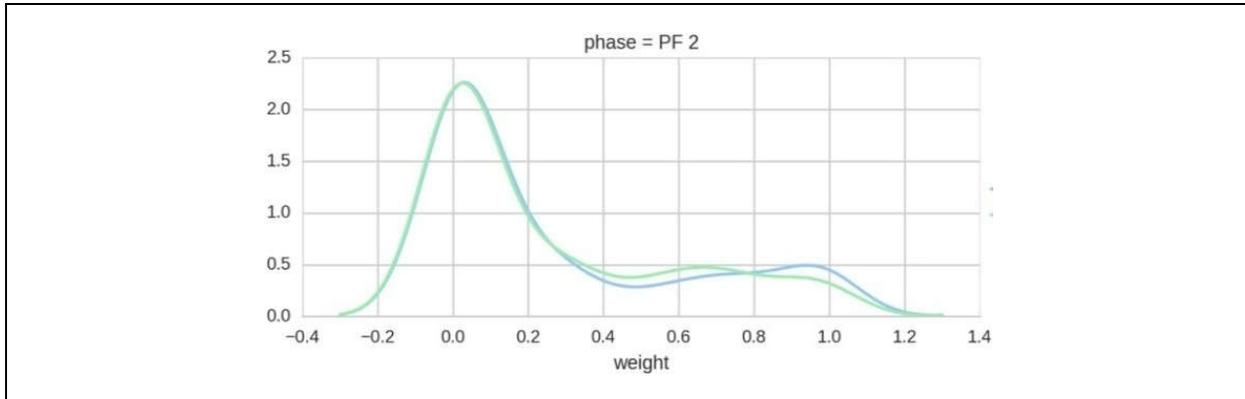
At a general level, it is striking to note the high proportions of probable nonlocals within both samples. In the case of Quattro Fontanili, depending on whether the lower threshold is set at or just above 0.7096, between 15 and 20 percent of the analyzed individuals yielded nonlocal signatures (7-9 out of 46). The proportion is even higher for Osteria dell'Osa, with nonlocals making up around a third of analyzed individuals (15 out of 46). Connections between the two areas may have been asymmetric. Only one of the Quattro Fontanili nonlocals falls within the Osteria dell'Osa range, whereas all but two or three of the ones from Osteria dell'Osa appear to have relocated from the area of Veio.

These preliminary data are especially tantalizing in light of the evidence for vernacular and other discontinuities associated with the PF 1-PF 2 transition within the Gabii subset. Differences in the demographic makeup of locals versus nonlocals buried at Osteria dell'Osa are not statistically significant either overall or within individual subphases, so that the high proportion of nonlocals cannot be attributed with confidence to marital exchange or other structured dynamics. It is important to stress that data from the remaining 12 samples from the site may alter this assessment. Based on the available results, however, if Gabii really did experience a temporary collapse around the PF 1-PF 2 transition, the large number of nonlocals from nearby Veio may reflect a general wave of opportunistic relocations.

Assuming that the local ranges identified above are not entirely misleading, overall the burials of locals may be expected to yield higher intra-subset p_{ij} averages than those of nonlocals. Depending on the relative distinctiveness of local vernaculars, however, along with many other factors, this difference could be masked by underlying relational 'noise'. As a result, section 3.1 also suggested that the expected pattern might only be evident beyond a p_{ij} threshold associated with the likelihood of a given edge belonging to an intra- versus inter-subset burial pair. For all chronological subdivisions captured by the reconstructed networks, density estimations derived from these two types of comparisons feature a low- p_{ij} mode extending up to approximately 0.25.

Intra- and inter-subset p_{ij} distributions are contrasted in detail in section 7.2, but this pattern can be observed even within the PF 2 plot in isolation (fig. 7.2). In the remainder of this section, therefore, I evaluate intra-subset relational averages for the burials of locals versus nonlocals using both all edge weights and only values greater than or equal to 0.25.

FIGURE 7.2 Comparison of intra- and inter-subset p_{ij} kernel density estimations, PF 2 (intra-subset pairs in blue, all inter-subset pairs in green).



Of the sampled individuals, 13 locals and 5 nonlocals from Quattro Fontanili and 26 locals and 10 nonlocals from Osteria dell’Osa are associated with suitable burials for network reconstruction (fig. 7.3; summary information concerning these burials is listed in table 7.2 at the end of the chapter). For each cemetery, I extracted data from edges between the burials of locals and those of non-sampled individuals and then between those of nonlocals and all others. In order to provide a point of reference, moreover, I also evaluated patterns of connectivity among the burials of non-sampled individuals in isolation. As expected, all three types of comparisons yield similar averages when the full range of p_{ij} values is considered (fig. 7.4). The averages from Quattro Fontanili are virtually identical, while in the case of Osteria dell’Osa the one involving burials of nonlocals is only slightly lower than the others. Excluding edges below the 0.25 threshold, however, increases the relative prominence of averages involving burials of locals for both cemeteries.

The data from Quattro Fontanili conform perfectly to expectations. Edges between local and non-sampled burials have a substantially higher average weight compared to ones between nonlocal and all other burials (0.63 versus 0.51). With a value of 0.59, the reference average comes close to the score obtained for locals, which could suggest that the majority of non-

sampled individuals were also native to the community. Osteria dell’Osa displays broadly similar patterns, but the reference average is closer to the value for nonlocals (reference: 0.80; nonlocals: 0.78; locals: 0.87). This difference seems consistent with the higher proportion of nonlocals at Osteria dell’Osa. Results from the remaining Osteria dell’Osa samples and the fauna will help refine these observations and perhaps also support other types of comparisons. For example, should the local isotopic ranges derived from the faunal data allow for precise determinations of geographical origin, it will be interesting to assess the degree of affinity between nonlocals and the spatial subsets from which they appear to have relocated. Future prospects aside, by supporting the interpretation of p_{ij} averages as indices of relational affinity, the preliminary results presented in this section supply an encouraging foundation for evaluating the other expectations outlined in chapter 3. I begin in the following section with the dynamics underlying the BF-PF settlement reconfiguration.

FIGURE 7.3 $^{87}\text{Sr}/^{86}\text{Sr}$ results for samples associated with suitable burials for network reconstruction (dotted lines correspond to probable local ranges discussed in the text; blue: lower limit for Veio subset; black: upper Veio/lower Gabii limit; red, upper Gabii limit).

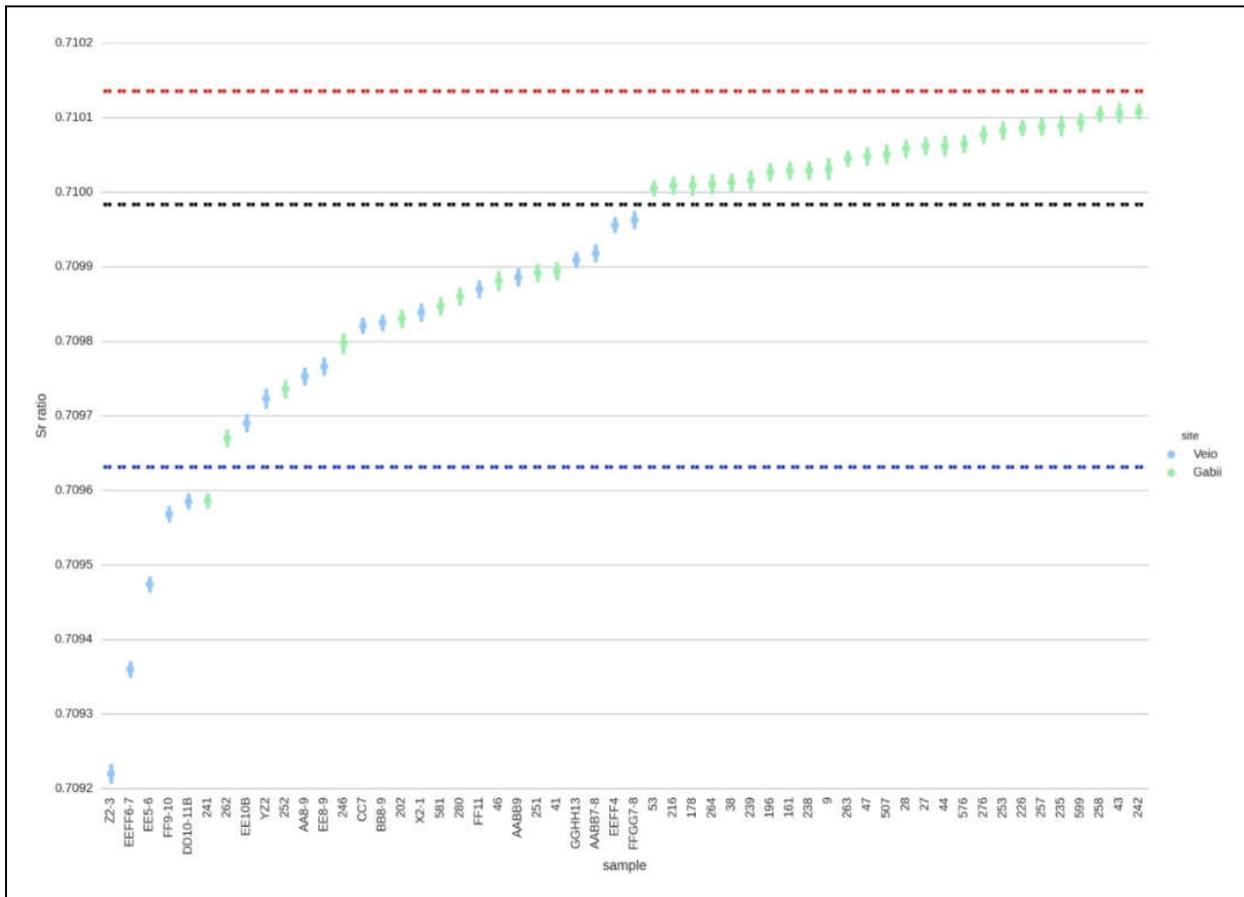
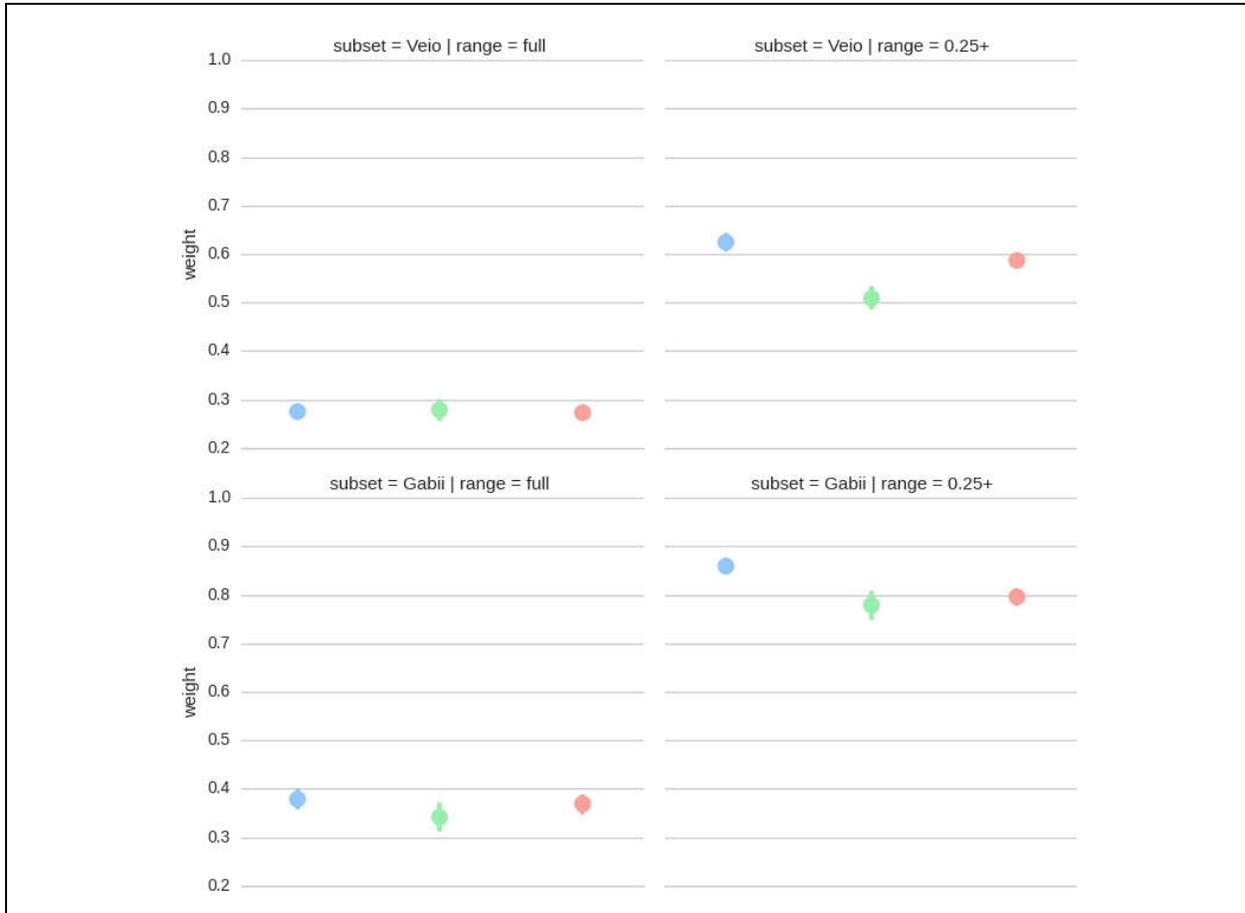


FIGURE 7.4 Comparison of relational averages associated with the burials of isotopically identified locals and nonlocals (blue: burials of locals versus non-sampled individuals from the same cemetery; green: non-locals versus locals and non-sampled individuals; red: non-sampled burials, for reference; top: Quattro Fontanili cemetery; bottom: Osteria dell'Osa; left: averaged derived from full p_{ij} range; right: p_{ij} values above the 0.25 threshold discussed in the text; vertical bars indicate 95 percent bootstrap confidence interval for each average).

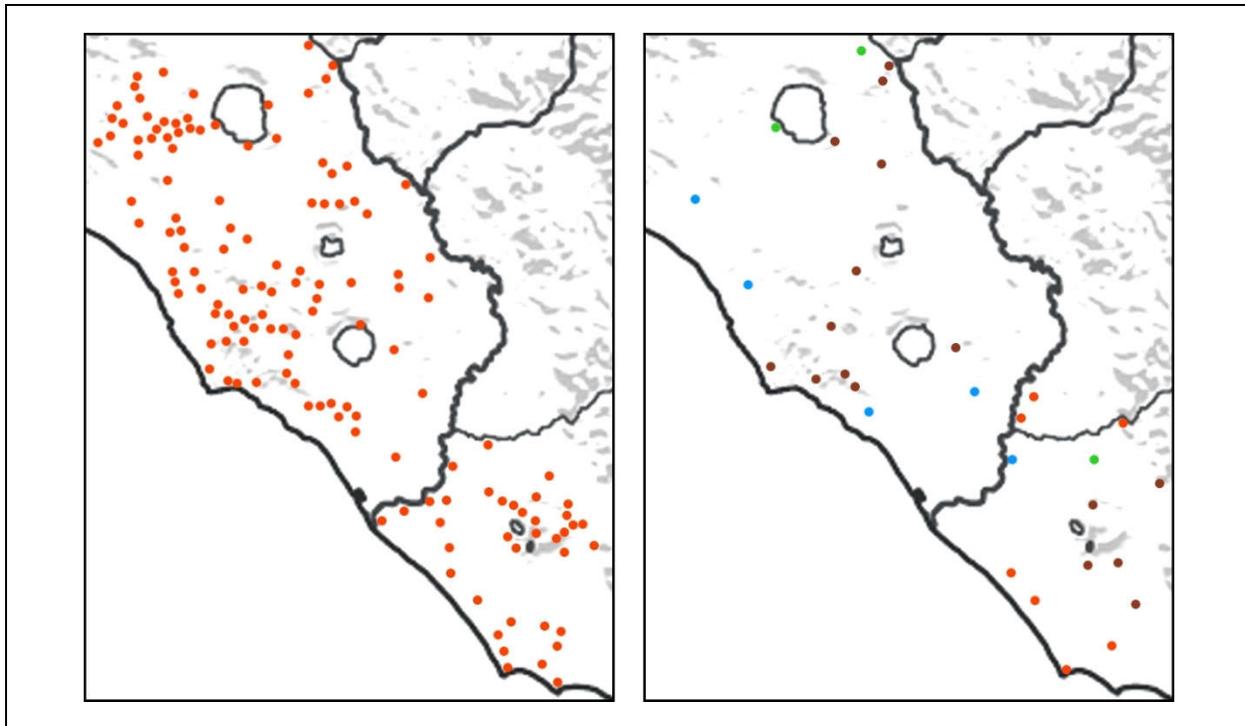


2. VERNACULAR RELATIONAL LANDSCAPES

As pointed out in section 3.2, the convergence of population from small settlements distributed evenly across TCI to a limited range of large centers must have had substantial relational ramifications. In the BF 3, northern and southern TCI featured similar densities of small settlements (approximately five hectares on average), many of which were located on naturally defensible features. With few exceptions, these settlements appear to have been abandoned by the early PF 1. In their place, scattered centers ranging in size from around 20 to 175 hectares formed on both sides of the Tiber (fig. 7.5). Settlement sizes and demographic estimates are discussed in more detail in section 7.4; the important observation for the purposes of this section

is that starting conditions in the BF 3 were comparable across the research area, so that the transition to the PF 1 would have involved the movement of thousands of people both in the north and south.

FIGURE 7.5 Comparison of settlement distributions during the BF 3 and PF 1 (left: BF 3; right: PF 1 centers larger than 20 hectares; the colors in the PF 1 map indicate approximate surface areas; orange: 20-50 hectares; green: 50-100 ha.; blue: 100-200 ha.; brown: size uncertain; data from Pacciarelli 1994:231, fig. 1; Pacciarelli 2001:108, fig. 60; Alessandri 2013:50, fig. 1.36).



It is commonly assumed that the process of settlement concentration was rationally planned by the ‘leaders’ of BF 3 communities or otherwise directed. In part, this may be due to a tendency to approach the BF-PF transition by working backwards from the later PF or even the historical period (for a recent, explicit formulation, see Bietti Sestieri 2009:12). For example, the pervasive ‘protourban’ model introduced in section 2.1 is rooted in the notion that the territories controlled by the historical Etruscan and Latin cities must have been encoded in the landscape all along. Historical circumstances toward the end of the BF simply activated natural attractors—topographic features characterized by some combination of proximity to major communication routes, availability of good agricultural land, defensive potential, and size, among other qualities. Once activated, these incubators of ‘Complexity’ exerted an irresistible pull on the surrounding communities, or rather their forward-thinking leaders. In the case of Tarquinia, for instance,

which is held as the quintessential example of the formation of a ‘Villanovan’ center,

Changing circumstances would have led to economic and demographic shifts favoring more complex sites within a context strongly oriented toward agricultural pursuits and mineral resources and connected to the sea and major communication routes. [...] the possibility of concentrating the population within a single site would have been established by way of a common agreement stimulated also by socially prominent individuals [...] In this way, the ‘Tarquinia group’, which approximated a proto-political league in character, found its natural seat [...] (Mandolesi 1999:190-191, my translation)¹⁵

In support of this view, the distribution of conventionally emphasized categories of material culture points to the gradual diversification of ‘culture areas’ (‘facies’ in the TCI literature). As outlined in the preceding chapters, most specialists argue that the transition between the BF 1-2 and BF 3 saw the emergence of a ‘Latial culture’ in contrast to a slightly more variable northern TCI cultural sphere, and that the spatial specificity of production and consumption patterns increased steadily thereafter.

Considerations of southern and northern TCI separately paint a somewhat more complicated picture for the latter. In the early PF 1, a common ‘Villanovan’ culture purportedly spread more or less successfully from Tarquinia to other northern TCI centers. Of course, the fact that most reconstructions specify a ‘cultural epicenter’ and track differential degrees of acculturation across the region implies that it is still very much possible to distinguish the emerging collectives from one another. With regard to mortuary treatment, for instance, “along the traits they hold in common, each of the major centers of Etruria is also characterized by its own exclusive ritual choices, the development of which results in ever greater local peculiarities over time” (Iaia and Pacciarelli 2012:349, my translation).¹⁶ As time wore on, in other words, the character of the natural attractors eroded affinities at increasingly fine-grained spatial scales, first between northern and southern TCI and then gradually within them.

I do not dispute that many of the PF centers occupied propitiously situated topographic features.

¹⁵ “Mutate condizioni avranno portato a uno spostamento di interessi economici e demografici a favore di siti più complessi, al centro di un ambito a forte vocazione agricola e mineraria, a contatto con il mare e le principali vie di comunicazione. [...] Attraverso un comune accordo, stimolato anche da personaggi accreditati sul piano sociale, si sarà stabilita positivamente, alla luce di particolari condizioni economiche raggiunte dalle comunità con elevati livelli di maturazione, la possibilità di occupare e accentrare la popolazione in corrispondenza di un’unica sede. [...] Così il ‘gruppo tarquiniese’, avvicicabile a una lega a carattere proto-politico, trovava la sua sede nel punto di riunione intercomunitario, contraddistinto da una connotazione sacrale”

¹⁶ “In effetti, accanto ai caratteri comuni, ognuno dei grandi centri dell’Etruria manifesta anche scelte rituali proprie ed esclusive, che nel tempo si sviluppano portando a sempre maggiori peculiarità locali”

Especially considering the element of intensifying conflict, however, an orderly process of nucleation seems improbable. As a result, in addition to deriving expectations for the ‘directed’ model, section 3.2 outlined relational correlates for a scenario of at least initially ‘organic’ circulation patterns. This scenario departs from the possibility—in my view, high probability—that BF 3 communities were far from monolithic, static entities. Even if similar and roughly contemporaneous pressures are envisioned across the research area, individuals, families, and other small subsets may have variously perceived them, been more or less willing to relocate, or have had entirely different views on how to confront them. Granted, beyond a certain threshold the choices of a highly responsive minority could have limited the range of action of the majority in each community, engendering apparently homogeneous cascades. As a result, it might still be reasonable to approximate an ‘organic’ process to the level of entire communities, but the important difference is that in this case abstract collective agency is not assumed to have been shaped by a restricted network of strategically minded decision-makers.

Variability in the specific concerns and choices of reactive subsets of communities and their timing relative to one another would likely have resulted in heterogeneous dynamics of interaction. In turn, this sort of convoluted dynamics should ultimately have had a homogenizing effect on patterns of affinity across TCI. Assuming that this possibility seems at least theoretically plausible, the problem becomes explaining how undirected dynamics could have occasioned in practice what might appear as strategically determined settlement choices. Again granting similar pressures, starting conditions, and a limited range of strategically suitable topographic features, the issue can be recast in terms of network searchability.

The ‘directed’ scenario essentially assumes a high-level network of leaders overlain on the forest of ties among ordinary social actors—hubs perched high up on the relational landscape who could effectively query and relay information about conditions in different areas, the actions of their peers and their consequences, and so on. As pointed out in early contributions to the study of complex networks, however, the phenomenon of network searchability can also be explained without reference to hubs. The average social actor has precise local knowledge of the network (i.e., knows a certain number of individuals intimately and by virtue of such connections may have accurate information about people whom those individuals know intimately). Because social systems tend to be characterized by multiple dimensions of identity, moreover, individuals

can estimate social distance globally, however imperfectly. It has been demonstrated that these two types of incomplete information combine to produce searchable networks over a broad range of values for the degree of homophily characteristic of a system and the number of actors and dimensions of identity that define them (Watts, Dodds, and Newman 2002; as pointed out in table 1.2, multidimensional ‘identity’ as defined in this model can be reconnected to the notion of relational planes). In the absence of compelling empirical evidence, therefore, patterns suggestive of a high degree of coordination cannot be assumed to imply the presence of coordinating agents.

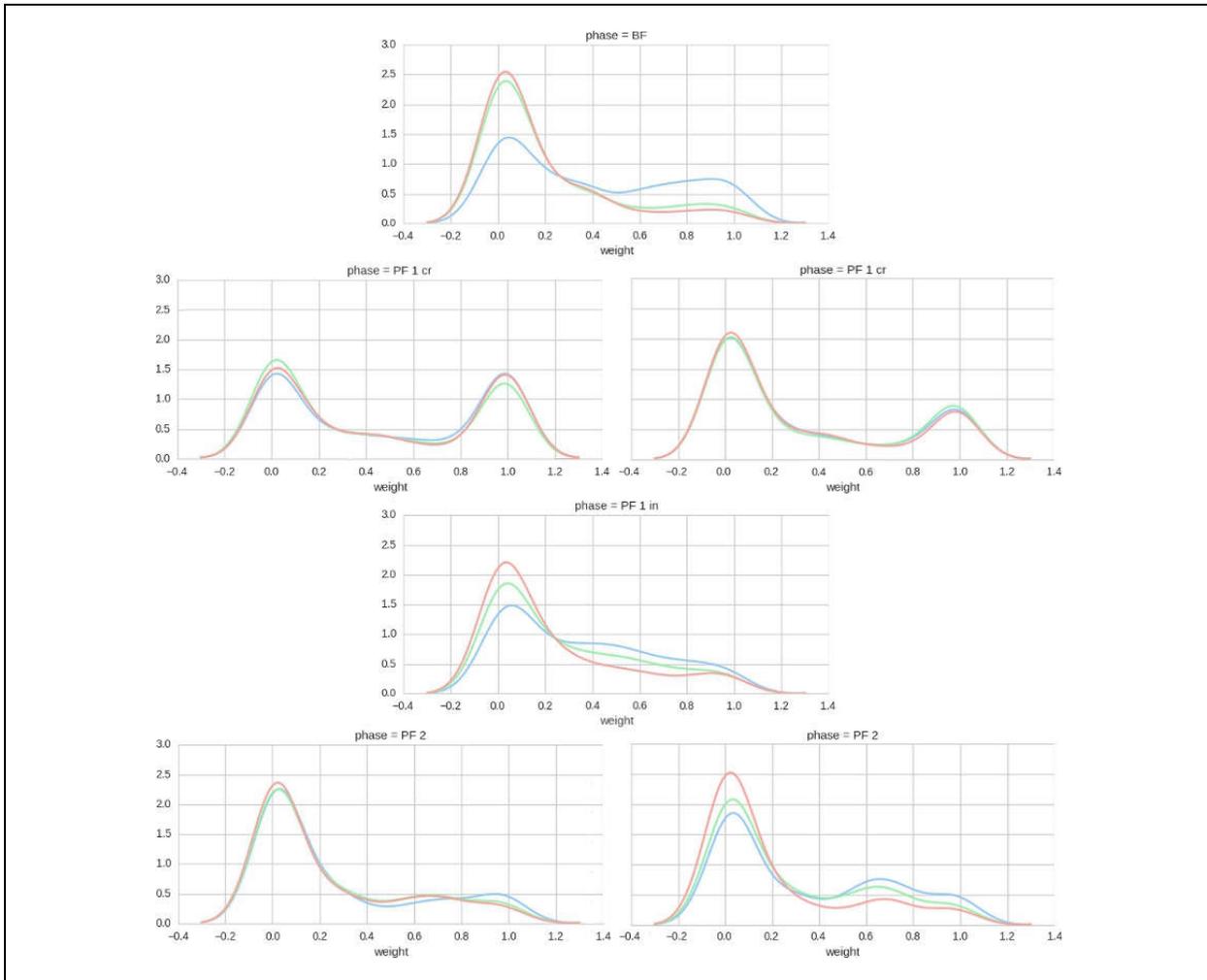
Considering the problem in network terms also provides a tidy way of summarizing the expectations proposed in section 3.2—given the many factors affecting ‘organic’ searchability even within the abstract formulation, under such a scenario the process of settling on a stable configuration would have been spatially noisy. As it turns out, intra- and inter-subset p_{ij} distributions derived from the phase-specific aggregate networks may point precisely to such a noisy process. Relational patterns violate boundaries given by the clustering of BF 3 settlements relative to the emerging centers as well as larger-scale ‘culture areas’ inferred on the basis of conventionally emphasized evidence (fig. 7.6).

With regard to the BF 3, p_{ij} values from all subsets represented in the aggregate network show that, on average, intra-subset pairs are more strongly connected than inter-subset pairs. As anticipated in the preceding section, the intra- and inter-subset distributions for this and the other phase-specific networks meet around a threshold of 0.25. Values below this threshold are more likely to belong to inter-subset pairs, whereas above it intra-subset pairs are progressively better represented. Overall, these patterns suggest a locally oriented relational landscape. Though far from isolated, BF 3 communities can be clearly picked out from the backdrop of inter-subset affinities. Perhaps most important, in contrast with the notion that a well defined ‘Latial culture’ began emerging in the BF 3, there is no evidence for a boundary along the Tiber. The distribution of values for all inter-subset comparisons is essentially identical to the one reflecting only cross-Tiber pairs.

Moving to the PF 1, the difference between the intra- and inter-subset distributions is not nearly as pronounced. In fact, in the case of the potentially earlier horizon represented by cremations,

they are essentially indistinguishable. Just as in the BF 3, there is no evidence for a boundary along the Tiber. If anything, affinities between subsets on different sides of the river appear slightly stronger than those within the conventionally recognized ‘Villanovan’ and ‘Latial’ areas. As suggested in chapter 5, this could be due in part to the existence of parallel inland and coastal circuits. This possibility is discussed in more detail in the following section, but for the present purposes it can still be useful to parse the general trends discussed so far at the level of individual subsets in order to gauge the impact of potential outliers on the shape of the distributions.

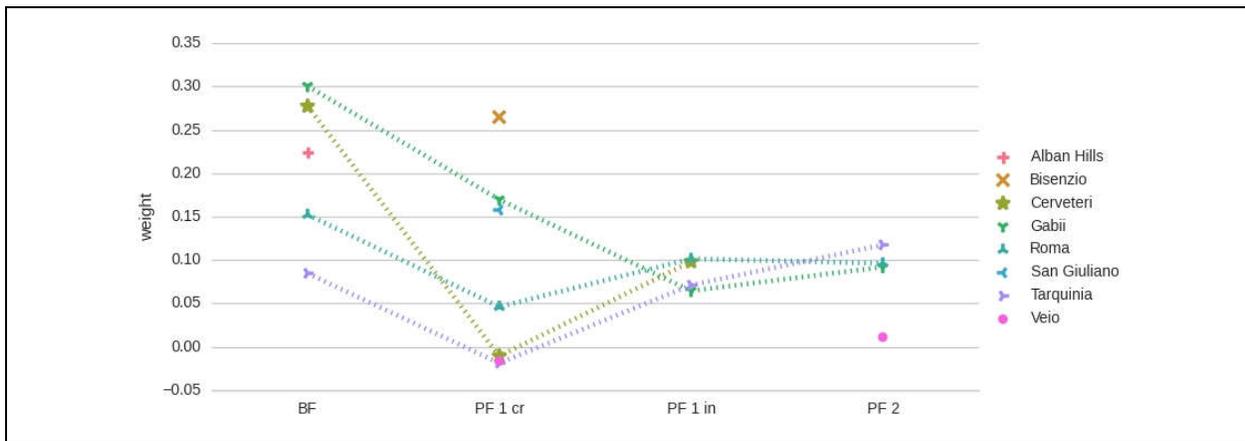
FIGURE 7.6 Phase-by-phase comparison of intra- and inter-subset p_{ij} kernel density estimations (intra-subset pairs in blue, all inter-subset pairs in green, and cross-Tiber pairs only in orange; from top to bottom, BF 3, PF 1 cremations, PF 1 inhumations, PF 2; for the PF 1 cremations and PF 2, the plots on the left display all subsets, those on the right exclude the outliers discussed in the text).



The magnitude of the discrepancy between the intra- and inter-subset comparisons can serve as an approximation of the relative insularity of individual subsets (fig. 7.7). Values for the BF 3

indicate that, without exception, connection strengths are higher among burials of a given subset than between them and those of other subsets. Although there are no clear outliers, according to this measure Cerveteri and Gabii appear as clearly demarcated features within the relational landscape, while Tarquinia and to a lesser extent Rome are less defined, though they can still be picked out. Moving to the PF 1 cremations, judging from subsets also represented in the BF 3, insularity decreases across the board. The magnitude of the change is comparable in the case of Gabii, Rome, and Tarquinia but substantially greater for Cerveteri. As a result, and in part due also to the addition of Bisenzio, San Giuliano, and Veio, which were not associated with sufficient samples of early burials to be included in the BF 3 comparison, it is possible to distinguish three levels of insularity. At the low end of the scale, Cerveteri, Tarquinia, and Veio are hardly distinguishable from the relational background, with Rome just above them. At the opposite extreme, Bisenzio approaches the highest BF 3 values. Gabii and San Giuliano occupy an intermediate position, with values close to the lower extreme of the BF 3 range.

FIGURE 7.7 Changes in the relative insularity of individual subsets over time (data points correspond to the difference between intra- and inter-subset p_{ij} averages).



In light of these patterns, not to mention the concerns raised in section 5.2 about the impact of extraneous variables on the PF 1 network, it might be supposed that the similar distributions for PF 1 cremations in figure 7.6 are largely a product of potentially inflated affinities between the southern TCI subsets and the interior areas of northern TCI. Excluding Bisenzio, Gabii, and San Giuliano as outliers, however, has no discernible effect on the relative distinctiveness of the three distributions (second plot for PF 1 cremations in fig. 7.6; removing Veio as well to reflect the frequent assumption that it was a later, derivative formation in the ‘Villanovan’ context is

similarly inconsequential; not illustrated in fig. 7.6).

Beyond the potentially earlier PF 1 horizon given by the cremations, when the inhumations are considered the intra-subset distribution regains primacy beyond the 0.25 threshold. Compared to the BF 3, however, it entirely lacks the extended high- p_{ij} mode that set it apart from the inter-subset distributions. This is also reflected in the plot of subset-by-subset differences. Although Gabii seems to lose some of its distinctiveness, Cerveteri, Rome, and Tarquinia all become better defined, so that overall the range of variability is restricted between 0.06 and 0.10—the floor for the BF 3.

Finally, the PF 2 data seem to suggest a partial reversal, with the intra-subset distribution losing intermediate p_{ij} values without a comparable increase at the high end of the range. The subset-by-subset differences reveal that this is largely due to the reintroduction of Veio within the sample. While the other three areas that yielded sufficient PF 2 data—Gabii, Rome, and Tarquinia—are clustered around 0.10, Veio appears just slightly more distinctive than suggested by its PF 1 cremations, with a value close to zero. As illustrated in the final plot in figure 7.6, in fact, the distributions obtained by excluding Veio arguably inch even closer to BF 3 patterns than those associated with the PF 1 inhumations.

Overall, these trends conform closely to the expectations outlined in section 3.2 for the ‘organic’ scenario. The only deviations concern the hypothesized process of stabilization after the early PF 1. Although the distributions derived from the PF 1 inhumations and the PF 2 do seem to move in the direction of BF 3 patterns, the presence of an outlier as pronounced as Veio in the PF 2 is surprising. Even after removing it, moreover, the difference between the intra- and inter-subset distributions is less pronounced than expected.

3. INTER-SUBSET AFFINITIES

Veio’s position as an outlier relative to other PF 2 subsets in figure 7.7 is especially interesting in connection with the issue of long-distance exchange and the impact of exogenous influences on TCI developmental trajectories. According to the prominent model introduced in section 3.3, Veio’s relatively late establishment as a hub for long-distance exchange routes occasioned major organizational changes within southern TCI, including the consolidation of Rome as a point of

convergence for both coastal and inland connections with southern Italy and the parallel decline of the Alban Hills. Ultimately, these shifts are thought to have spurred a qualitative jump from the ‘protourban’ formations of the PF 1 to the historically attested Etruscan and Latin cities.

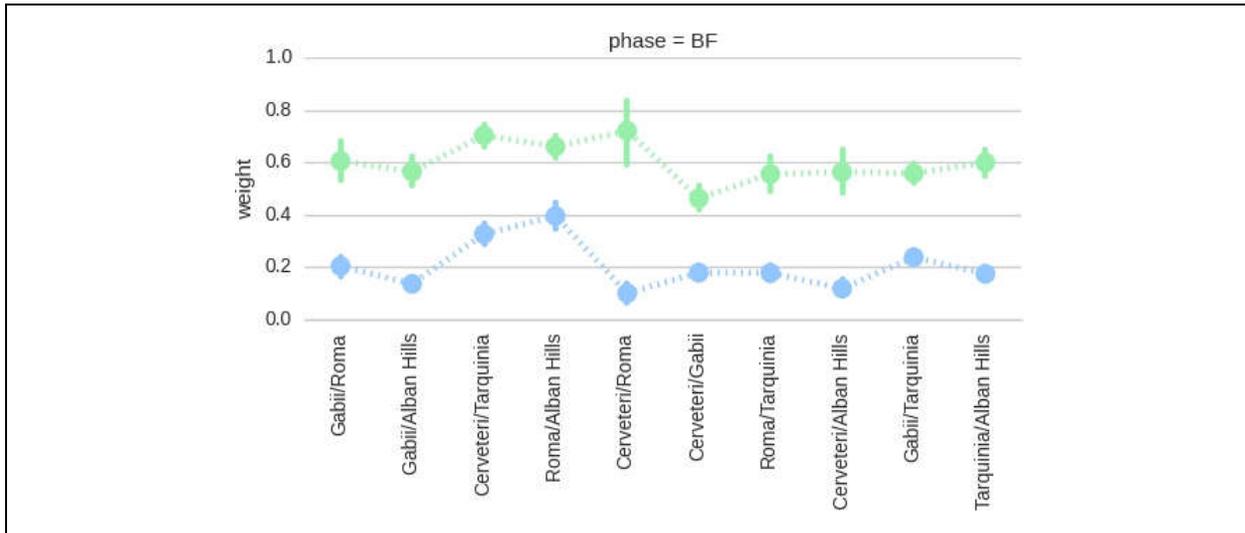
The networks presented in the preceding chapters include sufficient information to assess three components of the model—the relative prominence of the Alban Hills area versus Rome as focal points within southern TCI between the BF 3 and early PF 1, the development of a privileged channel of contact between Veio and Rome by the end of the PF 1, and the resulting erosion of direct contacts between the north and southern subsets other than Rome. To begin with, during the BF 3 the area of the Alban Hills is supposed to have played a key role within southern TCI as a point of convergence for the major north-south currents along the coast and the interior. Out of the three southern subsets encompassed by the BF 3 network, therefore, the Alban Hills should display the strongest affinities with coastal areas north of the Tiber.

The data presented in section 4.2 paint a more complicated picture. The averages between the Alban Hills and the northern subsets are comparable to or slightly lower than those associated with Rome and the Gabii subset (the latter represented by the Quadraro burial clusters). In light of the comparison of intra- and inter-subset distributions in the preceding section, however, it becomes interesting to reevaluate the issue using only p_{ij} values above the 0.25 threshold. As suggested by the results of the comparison with the isotopic data from PF 1b2-PF 2 Gabii and Veio, averages beyond this threshold may better approximate vernacular relational distances.

The resulting patterns still call into question the notion of the Alban Hills subset as a mediator between coastal routes and interior areas of southern TCI (fig. 7.8). Relational distances between the Alban Hills and the northern coastal areas are never substantially lower than in the case of the Rome and Gabii subsets. At the same time, the high- p_{ij} patterns deviate from the trends discussed in chapter 4 in two important respects. The averages between Gabii and the north appear dampened, while the one between Cerveteri and Rome is among the highest in the entire sample. The reduced prominence of cross-Tiber comparisons involving Gabii casts doubt on my observations concerning the importance of the coast-Gabii-Apennines route illustrated in figure 4.5. The strong affinity between Cerveteri and Rome, moreover, removes the difficulty posed by the latter’s stronger connection to Tarquinia than Cerveteri when considering the full p_{ij} range,

on which basis I had speculated that partially separate coastal and inland circuits could have existed already in the BF 3.

FIGURE 7.8 Comparison of BF 3 inter-subset averages (blue: full p_{ij} range; green: only values above the 0.25 threshold discussed in the text; vertical bars indicate 95 percent bootstrap confidence intervals for each average; subset pairings ordered by spatial distance).

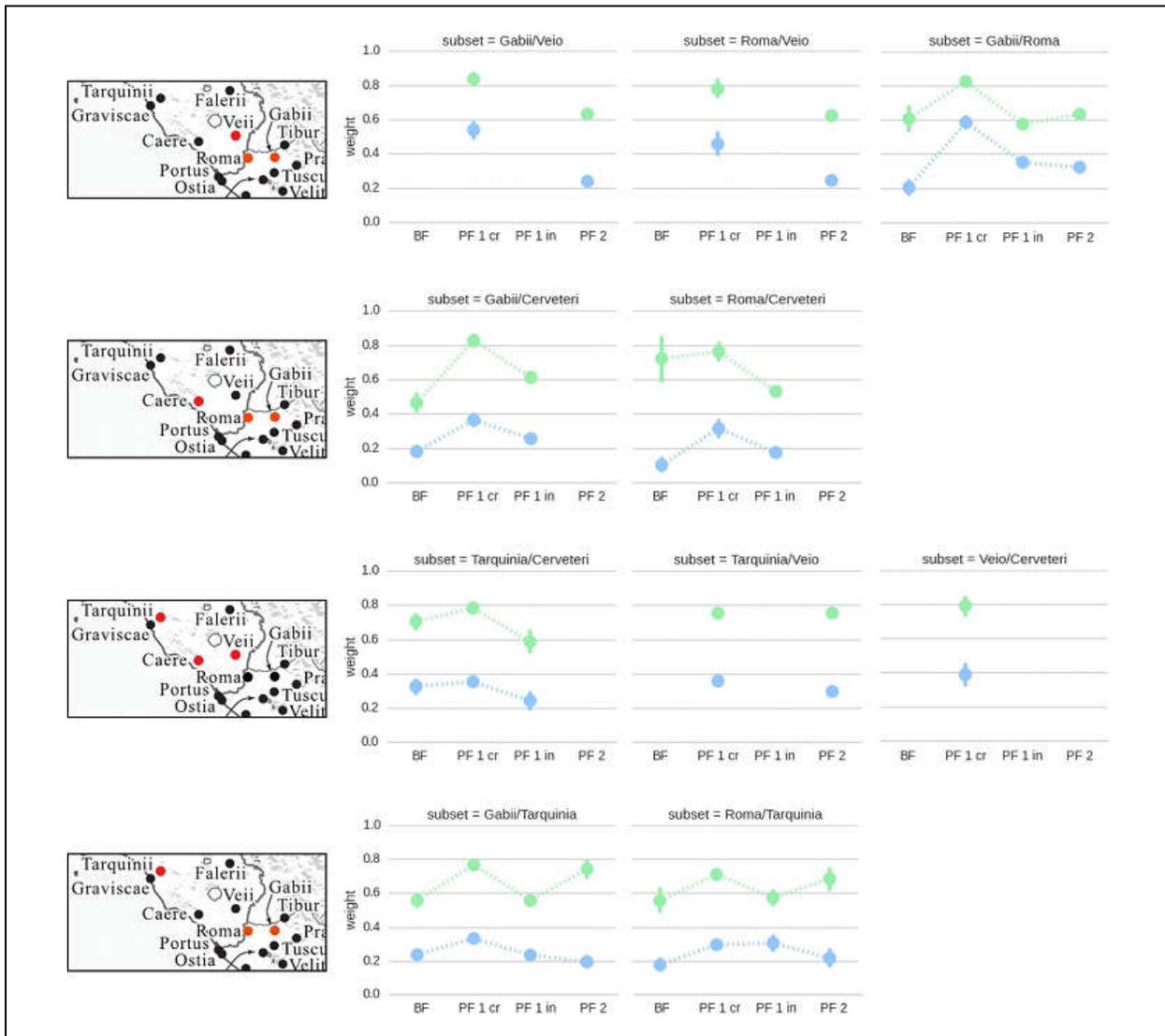


The BF 3 network thus rejects the first expectation derived from the exchange model, but it also calls into question the possibility that parallel inland and coastal circuits developed very early. Moving to the PF 1 and PF 2 networks, the availability of data from Veio makes it possible to evaluate more fundamental assumptions of the exchange model. Over the course of the PF, long-distance routes are supposed to have been redirected through Veio and by extension Rome. Section 3.3 argued that, under such a scenario, relational averages between Veio and Rome should increase or remain constant between the early PF 1 and the PF 2, so that by the end of the period they should exceed those between Rome and the coastal areas of northern TCI. With regard to the rest of TCI, averages for cross-Tiber pairs involving southern subsets other than Rome should decrease. These expectations can be altered slightly in recognition of the fact that all inter-subset averages appear to drop at least temporarily following the early PF 1 spike. Rather than remaining stable or intensifying in absolute terms, the connection between Veio and Rome should at the very least appear relatively resilient compared to other cross-Tiber comparisons.

Using averages derived separately from cremations and inhumations, section 5.2 suggested that the relationship between Veio and Rome is better understood in the context of a broader inland

circuit that also encompassed Bisenzio, Gabii, and San Giuliano. Then, in section 6.2 I argued that the incorporation of Tarquinia within this part of the network gradually polarized the inland circuit, resulting in the partial dissolution of the Gabii-Rome-Veio triangle by the PF 2. According to this preliminary reconstruction, the Veio-Rome connection never took the form of a privileged channel. Patterns adjusted for the 0.25 threshold support this conclusion (fig. 7.9).

FIGURE 7.9 Chronological development of subset-vs.-subset relational averages (the plots in each row compare relational averages among the subsets highlighted in the corresponding map; blue: full p_{ij} range; green: only values above the 0.25 threshold discussed in the text; vertical bars indicate 95 percent bootstrap confidence intervals for each average).



Gabii and Rome appear similarly close to Veio based on both the PF 1 cremations and the PF 2 data. Even proceeding from the revised expectation of relative resilience compared to other

cross-Tiber pairs, it would be difficult to claim any sort of special relationship between Veio and Rome. In contrast with the trends discussed in section 6.2, however, the adjusted patterns suggest that the introduction of Tarquinia into the fray did not affect the balance of the Gabii-Rome-Veio triangle—the PF 2 average between Gabii and Rome is comparable to the ones between each of them and Veio.

Based on the revised patterns, the only connections that could be characterized as relatively resilient involve not Veio but Tarquinia. After a dip associated with the PF 1 inhumations, the PF 2 averages between the latter and both Gabii and Rome return to the peak level given by the cremations. Veio is not associated with a sufficient number of PF 1 inhumations to evaluate whether its relationship with Tarquinia was also temporarily dampened, but again the PF 2 average between them is virtually identical to the one given by the PF 1 cremations.

On the whole, then, the networks presented in chapters 4-6 bear no traces of the relational trends implied by the exchange model. That is not to say that patterns of interaction inferred from the distribution of conventionally emphasized categories of material culture are necessarily misleading. The shifts at the root of the model may well capture relevant aspects of relational planes connected the circulation of metal resources and exotica. The problem lies with assuming that such forms of interaction must have driven the development of basic patterns of affinity within TCI rather than simply being anchored to them. Based on its anomalous PF 2 value in figure 7.7, for instance, it may be fair to characterize Veio as the sort of hub envisioned by the exchange model. Again, the individual inter-subset comparisons reject the broader ramifications that tend to be attributed to this potentially distinctive trajectory. Given the trends discussed in the preceding section, however, even disregarding this fact Veio could not be said to have revolutionized the TCI relational scene toward the end of the PF 1 as a new type of protagonist. If anything, its distinctiveness may reflect the more rapid stabilization of other subsets following the BF-PF reconfiguration.

4. FORM AND SUBSTANCE

As I have repeatedly noted, the settlement evidence points to relative homogeneity across the research area during the BF. This is apparent at first glance in the comparable distributions north and south of the Tiber displayed on the left in figure 7.5 and supported by the data on average

settlement extent presented below. The PF 1, on the other hand, seems to be associated with substantially greater regional variability, first and foremost in the size of the new centers. Particularly in light of the trends presented in the preceding sections, the development of such markedly different patterns north and south of the Tiber seems puzzling. In this section, I argue that it is probably illusory—the result of a tendency to focus on the form of the new centers rather than their substance. I begin by reviewing the available data for changes in settlement size and their implications.

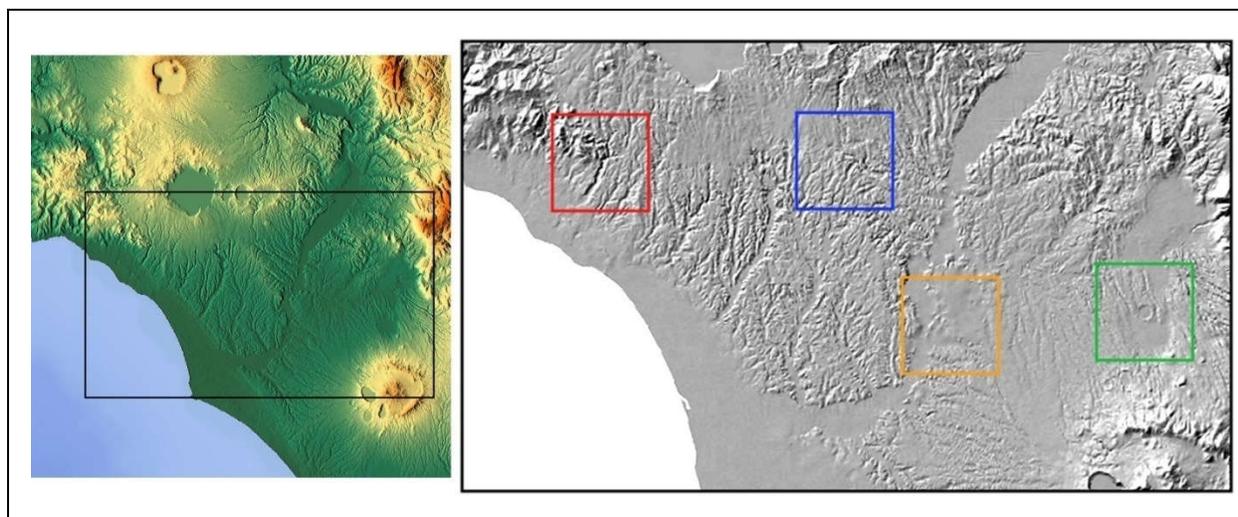
Especially when it comes to settlement patterns, northern and southern TCI tend to be considered separately. The literature still lacks a detailed reevaluation of the survey evidence from the two areas together, so that even basic estimates of settlement extent have to be collated from different sources. I relied on a seminal study of northern TCI and a recently published analysis of settlement networks in the south (di Gennaro 1986; Fulminante 2012). Including only sites documented archaeologically, estimates of surface area for a total of 57 northern settlements and 88 from the south yielded virtually identical averages (4.289 and 4.284 hectares, respectively). The degree of precision with which these averages agree is nothing more than a happy coincidence, of course, but the rounded figure of 4-5 hectares across the research area is probably significant, as explained below.

The centers of the PF 1, in contrast, vary widely in size from approximately 20 to 175 hectares. As illustrated in figure 7.5, the largest centers are almost all located north of the Tiber. Based on the same sources cited for the BF, the average for northern TCI climbs up to just over 110 hectares, while in the south it remains relatively low, around 45 hectares. This difference in scale is at the root of the notion that southern TCI was less ‘Complex’ overall than the north, at least in the early PF. I do not at all dispute that population size can be broadly indicative of the degree of articulation of decision-making structures within a community. In my view, however, it is misleading to assume even a rough correlation between the extent of PF settlements and their demographic substance.

Most of the northern centers were located on large and naturally well delimited volcanic plateaus. In a context of demographic aggregation driven in part by intensifying conflict, such features could have supported more organic trajectories of social cohesion while retaining the

advantage of safety in numbers. That is, at least initially the newly linked groups on the plateaus could have maintained some degree of spatial autonomy without having to expend significantly more social and material resources to ensure defensibility. This settlement option was simply not available in southern TCI, which on the whole is characterized by a very different geomorphology (fig. 7.10). Nevertheless, there is little doubt that the threat of inter-settlement conflict was still a major concern. In fact, it has been suggested that what may appear as naturally well defined features in the south in many cases were artificially modified precisely to enhance defensibility (e.g., Guaitoli 1984; cf. Pacciarelli 2001:120). In the absence of both extensive and naturally defensible morphologies, spreading out settlements over large surfaces would have required greater investment in the form of substantially modifying the underlying features, encircling larger perimeters with walls and ditches, and so on.

FIGURE 7.10 *Digital terrain models illustrating the geomorphological variability of TCI (in the enlarged grayscale view on the right, the colored outlines highlight the areas of major centers; red: Cerveteri; blue: Veio; orange: Rome; green: Gabii; adapted from Ancient World Mapping Center).*



In section 3.4 and the discussion of the Gabii subset in section 6.1, I raised the possibility that such constraints could have provided an incentive for greater spatial concentration within much of southern TCI and in areas of the north that also lacked large and clearly delimited plateaus (e.g., Bisenzio; sections 4.1 and 5.1). Accepting this scenario would essentially involve replacing the assumption of a broad positive correlation between the surface area of settlements and their population with one of negative correlation between area and settlement density. There is not nearly enough settlement evidence to evaluate these assumptions directly, but working out their demographic implications may help establish relative plausibility.

Even in the BF, population densities within individual settlements could have varied depending on the extent and morphology of defensible features, among many other factors. The outline of the Bisenzio subset in section 4.1 gave as an example the neighboring settlements of Sorgenti della Nova and Sovana, which were anchored to naturally defensible areas of approximately five and 16 hectares. Unusually for TCI, both sites have been excavated extensively, and it has been noted that huts and other structures are clustered much more densely in the former (Cardosa 2004:258-259). Of course, density of structures need not equate precisely to population density, but this difference between Sorgenti della Nova and Sovana is suggestive in relative terms.

With regard to actual population estimates, an inverse relationship between surface area and density has been proposed for a slightly earlier Bronze Age context in northern Italy that is associated with much better data from settlement excavations (the ‘Terramare culture’). According to this work, settlements of less than 2, 2-10, and over 10 hectares were probably characterized by average densities of 150, 100, and 80-85 individuals per hectare (Cardarelli 1997). For TCI, a recent contribution proposes a range of 100-150 individuals per hectare during periods of peak occupation (presumably late horizons of the BF and PF; di Gennaro and Guidi 2010), which overlaps with frequently cited estimates in the broader archaeological literature on Bronze Age demography (e.g., 100 individuals per hectare in Kramer 1982, based on ethnoarchaeological evidence). At the other extreme, systematic analyses of the scarce data from PF 1 settlement excavations have led to estimates as low as 17-45 individuals per hectare for the largest centers of the early PF 1 (Rajala 2006).

It is not useful to quibble over precise figures until more settlements have actually been excavated. Here I simply wish to show that extending even a moderate population density estimate indiscriminately to all the PF 1 centers produces figures that seem improbable by an order of magnitude or more. In contrast, estimates obtained by applying a sliding scale of density in relation to settlement extent make more sense in terms of the similar starting conditions throughout the research area in the BF. Just as important, such estimates can be connected to independently predicted thresholds associated with diversity and experimentation in decision-making structures, or in other words precisely the sort of dynamics whose importance has been emphasized in recent work on the emergence of large social collectives (e.g., Wright 2006).

Proceeding from the estimates of surface area presented above for the BF and PF 1, I derived hypothetical population figures under both the conventional assumption of comparable densities and the possibility of an inverse relationship between area and density. For the former, I used an average of 85 individuals per hectare, which is roughly between low and high figures proposed in the recent literature on TCI demography (17 and 150; respectively, Rajala 2006 and di Gennaro and Guidi 2010). For the alternative assumption, I started with the Terramare figures for the smaller settlements and then worked down to the lowest estimate of 17 (table 7.1). As indicated in the table, the area ranges for most density categories were set arbitrarily. Applying this scale will not yield precise population estimates. The point is simply to examine at a very general level the implications of assuming a positive correlation between surface area and population versus a negative one between area and density.

TABLE 7.1 *Sliding scale used for the population estimates illustrated in figure 7.8.*

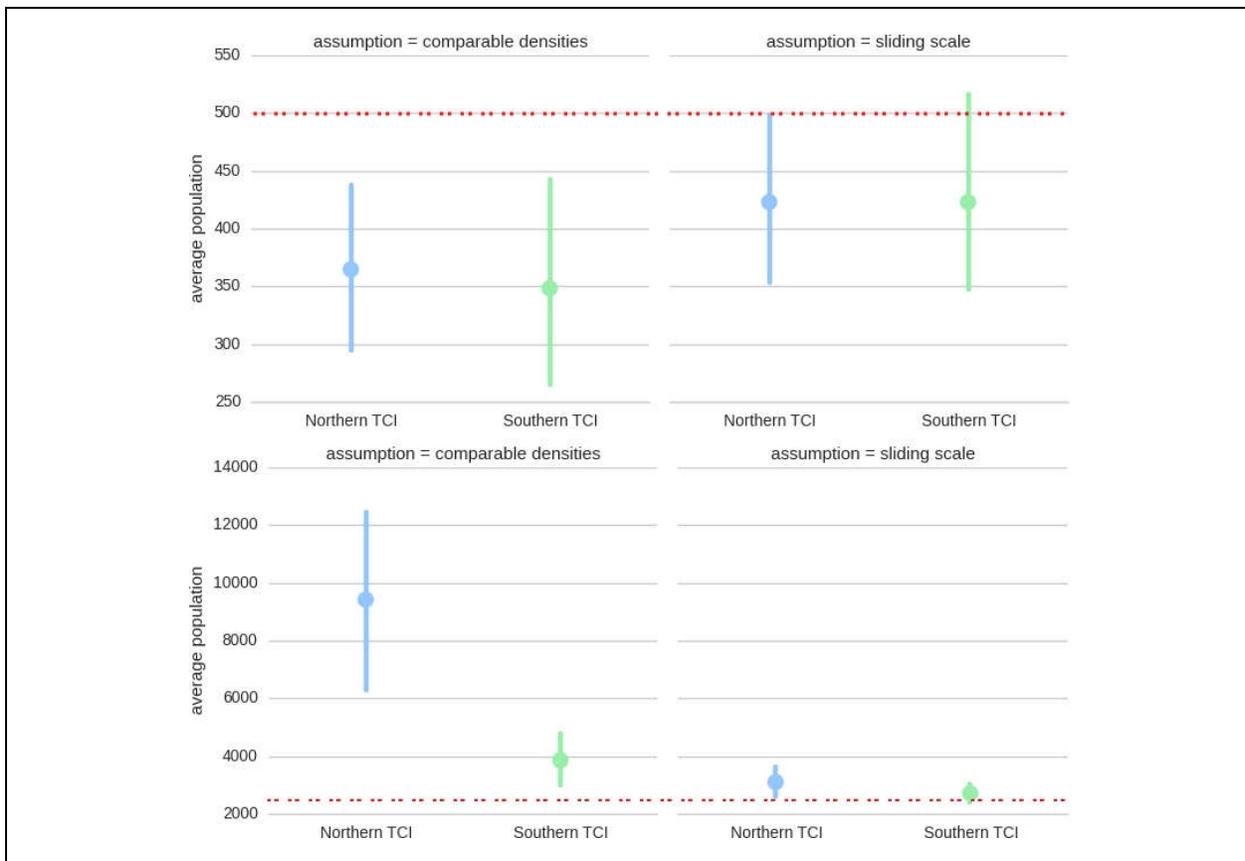
<i>Surface area (ha.)</i>	<i>Average density</i>	<i>Source(s)</i>
< 2	150	Cardarelli 1997; di Gennaro and Guidi 2010
2-10	100	Cardarelli 1997; di Gennaro and Guidi 2010
10-50	85	Cardarelli 1997 (upper limit arbitrary)
50-100	45	Rajala 2006 (limits arbitrary)
> 100	17	Rajala 2006 (limit arbitrary)

In the case of the BF, under both assumptions northern and southern TCI are associated with comparable distributions of hypothetical population estimates (fig. 7.11, top row). Additionally, it is interesting to note that the averages hover just below 500 individuals. This figure crops up frequently in discussions of the development of specialized decision-making groups within expanding communities (e.g., Naroll 1956; Johnson 1982; Lekson 1996; Kosse 1990 and 2001). Based on large ethnographic and archaeological samples, it appears that such groups are seldom present in communities smaller than 500 ± 100 individuals; between this threshold and 2500 ± 500 they are frequently present and highly variable; beyond the latter threshold they are almost always attested.

The thresholds of 500 ± 100 and 2500 ± 500 individuals make sense in network terms. Studies of cognitive limitations on the ability of humans to maintain functional relationships have identified upper limits between approximately 100 and 300 ties (e.g., Dunbar 1992; McCarty et al. 2000).

The implication, at least in my view, is not that individuals only really ‘know’ 100-300 other people, but that the number of relationships that define their position within each of the potentially overlapping relational planes in which they participate hovers in that range. Decision-making structures within a given community can be anchored to multiple relational planes, of course, but in most cases it may be reasonable to assume that they are largely limited to adults. Depending on its exact demographic composition, a community at the lower threshold of 500 would include roughly 200-300 adults.

FIGURE 7.11 Comparison of averages derived from distributions of hypothetical settlement sizes under different density assumptions (top: BF; bottom: PF 1; red dotted lines correspond to the thresholds of 500 and 2500 individuals discussed in the text; vertical bars indicate 95 percent bootstrap confidence intervals for each average).



With regard to the second threshold, it is hard to fathom that core decision-making groups could have involved all or even a significant proportion of adults in communities of around 2500 people. Accordingly, alternative decision-making structures may be expected to emerge at some point between 500 and 2500 individuals. The higher threshold may be significant in terms of the approximate number of extended families in a community around that size (cf. Lekson n.d.).

Using a range of 10-20 individuals for the size of extended families and assuming that each family would have been represented by one person results in a decision-making core of 125-250 individuals, which is a perfectly plausible range in network terms.

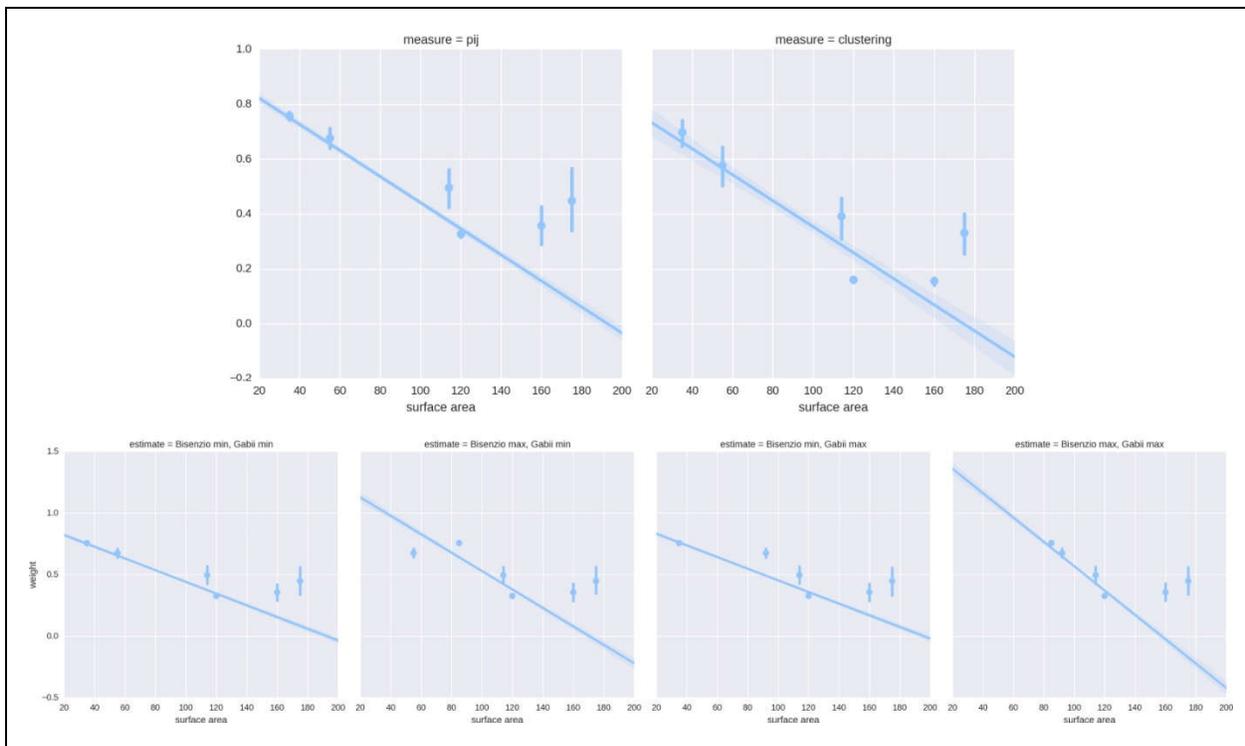
Based on these considerations, a shift from many communities of just below 500 in the late BF to a few centers close to the second threshold of 2500 in the early PF 1 would be unproblematic. The dynamics I hypothesized in connection with the issue of network searchability (section 7.2), in fact, could be expected to result in the emerging centers stabilizing precisely around this sort of threshold—an example of self-organization shaped by complex social factors and local contingencies interacting with basic biological and environmental parameters. Populations well above this threshold, on the other hand, would imply that not only most adults but most extended families were ‘disenfranchised’ in one way or another within a relatively short timeframe. Under certain conditions, such as might occur within individual communities making their way gradually through the unstable relational landscape between the two thresholds, this scenario would not be unfathomable. In the case of TCI, however, it would suggest that thousands of families from hundreds of communities all opted to submit to higher authorities according to a uniform rationale or simply had no say in the matter.

The conventional assumption of comparable densities involves accepting the latter scenario. The highly variable PF 1 surface areas yield substantially different estimates north and south of the Tiber (bottom left plot in fig. 7.11). The average of around 4000 individuals for the southern TCI centers could still be reconciled with the expected threshold, but north of the Tiber the figure climbs up to 10,000. Even putting aside the thresholds, it would be very difficult to account for the development of such markedly different regional patterns within a context characterized by homogeneous starting conditions and an apparently high degree of inter-subset connectivity.

Applying a sliding scale, on the other hand, results in comparable averages hovering just above the expected threshold throughout TCI (bottom right plot in fig. 7.11). It is important to note that modifying the scale by altering the arbitrary surface area limits only affects the implications of the results if the third density category of 85 individuals per hectare is extended to surfaces well above 100 hectares (cf. table 7.1). At that point, of course, the scale would approximate the assumption of similar densities across the research area, defeating the point of the comparison.

The plausibility of the assumption of negative correlation between settlement extent and population density can also be evaluated without invoking hypothetical population estimates. Section 3.4 suggested that rates of network densification within the newly formed centers might have differed as a function of population density, so that a strong negative correlation between surface area and population density should translate approximately to a negative correlation between surface area and both average intra-subset p_{ij} values and the measures of average clustering derived from them. The network obtained from the PF 1 cremations, which may capture a period shortly after the formations of the new centers, encompasses a reasonable number of subsets to evaluate these arguments. The expected negative correlation is evident based on both network measures considered (fig. 7.12; note that the points and confidence intervals within the p_{ij} and clustering plots represent averages of hundreds or thousands of values, depending on the subset).

FIGURE 7.12 Relationship between surface area of settlements and p_{ij} averages and clustering for intra-subset pairs (PF 1 cremations; surface area on the horizontal axis, in hectares; top left: p_{ij} averages; top right: average clustering; the bottom row of plots compares results obtained using the different estimates for surface area discussed in the text; from left to right, in hectares: Bisenzio 35/Gabii 55, Bisenzio 85/Gabii 55, Bisenzio 55/Gabii 92, Bisenzio 85/Gabii 92; vertical bars indicate 95 percent bootstrap confidence intervals for each average).



Particularly in the case of Bisenzio and Gabii, substantially different estimates of surface area have been published, so that relying on one or another combination of low versus high estimates could affect the results. It is interesting to note that both centers occupy a peculiar position in the debate over the relative ‘Complexity’ of northern and southern TCI. As noted in previous chapters, in many early contributions Bisenzio was considered a minor center and its extent estimated around 35 hectares. Eventually, several researchers began noting that, despite its problematically small size under the conventional equation between surface area and population, in other respects it appeared not at all ‘second-tier’. Compared to other northern centers, moreover, Bisenzio developed on a morphologically less defined feature. This prompted the authors of major syntheses to take a second look at the survey evidence, resulting in a new estimate of around 85 hectares (e.g., Pacciarelli 1994:236-237). Gabii, on the other hand, is frequently mentioned along with Rome as one of the potential exceptions to the ‘rule’ of smaller centers in southern TCI. As it became common to cite it in this way, estimates of its extent also crept up (e.g., 92 hectares in Fulminante 2012).

I am not at all suggesting that either of these high estimates was derived disingenuously, but confirmation bias may have played a role in the magnitude of the revisions, just as I am sure that it must have affected some of my own analytical choices. In line with these considerations, the plots in the top row of figure 7.12 are based on low estimates for both sites (35 hectares for Bisenzio and 55 for Gabii, given respectively in di Gennaro 1986:142 and Pacciarelli 1994:239; note that the latter contribution also provides higher estimates). The plots in the bottom row display correlations for p_{ij} values obtained using different combinations of low and high estimates for these sites. The effects are not substantial, suggesting that it may be reasonable overall to claim a negative correlation between the strength of intra-subset connections and surface area—the PF centers may have been more similar in substance than implied by their formal variability.

TABLE 7.2 Analytical results and attributes pertaining to burials included in the pilot isotopic study of PF 1b2-PF 2 Quattro Fontanili and Osteria dell'Osa (given as QF and OO).

Burial	Phase	Sex	Age	Sample	$^{87}\text{Sr}/^{86}\text{Sr}$	Prob. origin	Intra-subset p_{ij} average	
							full range	0.25+
OO-161	2a-b	F	> 50	M2	0.710029	local	0.374	0.886
OO-178	2c	F	< 18	M2	0.710009	local	0.373	0.921
OO-196	1b2	M	> 50	M2	0.710027	local	0.433	0.795
OO-202	1b2	F	> 50	C	0.709830	nonlocal	0.280	0.578
OO-216	1b2	F	18-50	M2	0.710009	local	0.397	0.872
OO-226	2a-b	F	18-50	M2	0.710086	local	0.371	0.927
OO-235	2c	F	> 50	M2	0.710089	local	0.375	0.887
OO-238	2c	M	18-50	M2	0.710029	local	0.374	0.886
OO-239	2c	M	18-50	M2	0.710016	local	0.371	0.927
OO-241	2a-b	ind	ind	M1	0.709586	nonlocal	0.258	0.591
OO-242	2	F	< 18	M1	0.710108	local	0.371	0.927
OO-246	2a-b	F	18-50	M2	0.709797	nonlocal	0.381	0.890
OO-251	2c	F	18-50	M2	0.709892	nonlocal	0.381	0.890
OO-252	2a-b	F	> 50	M1	0.709736	nonlocal	0.377	0.929
OO-253	2a-b	M	< 18	M2	0.710083	local	0.371	0.927
OO-257	1-2	M	> 50	M3	0.710088	local	0.434	0.847
OO-258	2a-b	M	> 50	M2	0.710105	local	0.238	0.895
OO-262	2a-b	F	> 50	M2	0.709670	nonlocal	0.258	0.591
OO-263	2a-b	F	> 50	C	0.710045	local	0.238	0.894
OO-264	2c	M	> 50	M2	0.710011	local	0.375	0.887
OO-27	1b2	F	18-50	M2	0.710062	local	0.397	0.872
OO-276	2a-b	M	> 50	C	0.710077	local	0.288	0.491
OO-28	1b2	F	18-50	M2	0.710058	local	0.397	0.872
OO-280	2a-b	M	> 50	M2	0.709860	nonlocal	0.258	0.591
OO-38	1b2	F	18-50	M2	0.710013	local	0.433	0.846
OO-41	1b2	F	18-50	M2	0.709894	nonlocal	0.440	0.850
OO-43	1b2	F	> 50	M2	0.710106	local	0.434	0.847
OO-44	1b2	F	18-50	M2	0.710062	local	0.397	0.872
OO-46	1b2	M	18-50	M2	0.709881	nonlocal	0.381	0.890
OO-47	1b2	F	18-50	M2	0.710048	local	0.433	0.846
OO-507	1b2	F	18-50	M2	0.710051	local	0.397	0.872

OO-53	1b2	F	18-50	M2	0.710005	local	0.370	0.894
OO-576	1b2	F	> 50	M2	0.710065	local	0.436	0.844
OO-581	1b2	F	18-50	M2	0.709847	nonlocal	0.403	0.875
OO-599	1b2	F	> 50	M2	0.710094	local	0.371	0.927
OO-9	1b2	M	18-50	M2	0.710031	local	0.397	0.872
QF-AA 8-9	2c	ind	18-50	M2	0.709753	local	0.304	0.711
QF-AABB 7-8	2a	ind	ind	M2	0.709918	local	0.245	0.633
QF-AABB 9	1-2	ind	< 18	M2	0.709886	local	0.246	0.603
QF-BB 8-9	1-2	ind	< 18	M1	0.709825	local	0.294	0.672
QF-CC 7	2a	ind	ind	M1	0.709821	local	0.256	0.417
QF-DD 10-11B	1-2	ind	18-50	M3	0.709585	nonlocal	0.298	0.677
QF-EE 10B	2a	ind	18-50	M2	0.709690	local	0.289	0.656
QF-EE 5-6	1-2	ind	ind	M2	0.709474	nonlocal	0.267	0.440
QF-EE 8-9	2a	ind	< 18	M3	0.709766	local	0.219	0.753
QF-EEFF 4	2b	ind	< 18	M2	0.709956	local	0.302	0.699
QF-EEFF 6-7	2b	ind	ind	C	0.709360	nonlocal	0.280	0.407
QF-FF 11	2b	ind	18-50	C	0.709870	local	0.295	0.672
QF-FF 9-10	1-2	ind	ind	M1	0.709568	nonlocal	0.296	0.663
QF-FFGG 7-8	2b	ind	< 18	M2	0.709963	local	0.304	0.710
QF-GGHH 13	2b	ind	ind	M2	0.709909	local	0.296	0.677
QF-X 2-1	1-2	ind	ind	M2	0.709839	local	0.291	0.461
QF-YZ 2	1-2	ind	ind	C	0.709723	local	0.234	0.638
QF-Z 2-3	2a	ind	ind	M2	0.709220	nonlocal	0.252	0.440

CHAPTER 8: SUMMARY AND CONCLUSION

This dissertation considered the emergence of large social collectives in late-prehistoric TCI by tracking relational patterns within a systematically validated relational plane. This approach follows perspectives that emphasize the importance of parsing the dynamics underlying supposed qualitative changes in the form of social collectives (e.g., Marcus 1992; Anderson 1994; O’Shea and Barker 1996; Wright 2006). It has long been observed that even canonical cases of state formation and urbanization display a broad range of formal variability (e.g., Flannery 1998; Yoffee 2004). Taken to an extreme, recognition of this fact and dissatisfaction with unidimensional approaches to ‘Complexity’ have engendered pointed critiques of comparative frameworks, or at least of comparison rooted in the idea that social diversity reflects something more than the accumulation of historical contingencies (Pauketat 2007; Routledge 2013).

Like many other contexts on the fringes of the ‘Classical World’, late-prehistoric TCI supplies a good case study to consider these issues. Since the late 19th century, research on this context has been torn between disciplinary traditions skewed toward either historical particularism or cross-cultural comparison (cf. section 1.3). Despite the common ground established by the dissemination of materialist approaches after the Second World War, tension between these frameworks is evident even in recent work:

In the face of what may appear a distinctive and [recognizable] phenomenon when considered globally—the birth of a homogenous group of *Early States*—when the investigation deepens [...] the timing and modes of the [BF-PF] transformation appear different. Accordingly, the reasons behind this change can also be scaled and distinguished [...] (di Gennaro and Guidi 2009:432-433, my translation; “Early States” given in English in the original)¹⁷

¹⁷ “A fronte di un fenomeno caratteristico e distintivo se considerato globalmente—la nascita di un gruppo omogeneo di *Early States*—allorquando si approfondisce l’indagine, esaminando i dettagli delle diverse unità di osservazione, tempi e modi della trasformazione appaiono differenti. Anche le ragioni del cambiamento possono dunque essere scalate e differenziate con riguardo alle possibili diversità all’interno della regione in cui si manifesta precocemente la nascita dei grandi centri del Primo Ferro”

The use of the concept of *protourban centers* [...] was and is certainly useful to fix terminologically a certain emerging reality. Still, it should never be forgotten that our capacity for creating labels falls infinitely short of the extreme complexity of the real world, especially considering that we are concerned with a highly heterogeneous and rapidly evolving historical context. [...] Just as the various centers differ in forms of aggregation, size, internal arrangement, and tempo of development, so too we ought to envision substantial variability in forms of [social] organization and the causal links at their origin (Pacciarelli 2009:396, my translation)¹⁸

Ultimately, TCI tends to be viewed as a mosaic of developmental compartments hatching different configurations of social collectives in response to changing historical circumstances (fig. 8.1 at the end of the chapter, model illustrated at the left). From this standpoint, the objective for archaeology is to delineate historically meaningful constellations of collectives. In practice, relations are inferred from the relative position of sites and the incidence of direct formal parallels among excavated assemblages. Zooming in from this level, the task is to identify individuals who embody salient facets of the economic, ideological, and political quality of each collective—founders, priests, slaves, warriors, and so on. That is, from this perspective individuals and other constituent social entities inherit from the apparent quality of collectives rather than the other way around.

Calls to analyze in detail the dynamics that shape developmental trajectories may carry the same implications for this sort of approach and others rooted in the formal characterization of social collectives as the introduction of spectroscopy for optical astronomy (fig. 8.1, right; cf. section 2.2). In combination with data derived from purely optical observation, the spectral dimension pointed to a useful classificatory scheme for the explanation of stellar evolution, which is represented by the Hertzsprung-Russell diagram at the bottom right of figure 8.1. Following this analogy, the challenge becomes to identify tools that can support rigorous comparison and classification of relational dynamics from the bottom up. As argued in the introductory chapters, such tools are being developed in the context of research on complex networks, raising the prospect of a social spectroscopy.

¹⁸ “L’uso del termine di *centri protourbani* per alcune delle maggiori e più innovative forme di organizzazione comunitaria dell’Italia protostorica è stato ed è certamente utile per fissare a livello terminologico una certa realtà emergente. [...] Non va tuttavia mai dimenticato che la nostra capacità di creare etichette è infinitamente inferiore rispetto all’estrema complessità del reale, soprattutto considerando che ci muoviamo in una situazione storica molto variegata oltre che in rapida evoluzione. [...] Come differiscono le forme di aggregazione dell’insediamento, la sua estensione ed il suo assetto interno, nonché il processo di sviluppo nel tempo dei vari centri, così si deve pensare a una sensibile variabilità delle forme di organizzazione delle comunità e dei nessi causali che ne sono all’origine”

Beyond selecting appropriate analytical tools, it is crucial to identify components of the record that are likely to reflect a coherent relational plane and then validate the connected assumptions systematically. Most considerations of TCI emphasize site-level economic, ideological, and political connections. In contrast, chapters 2 and 3 proposed to trace the development of a vernacular relational plane in terms of variability in the composition of clay-object components of burial assemblages and outlined how networks reconstructed from such data could be used to evaluate established models. With regard to the validity of the theoretical grounds and network reconstruction parameters at the root of this approach, I argued that mortuary vernaculars should reflect at least broadly patterns of direct interaction among various spatial subsets of TCI. As discussed in section 7.1, comparison between relational measures extracted from the reconstructed networks and preliminary results from a pilot isotopic study of mobility patterns conform to this expectation.

Chapters 4-6 surveyed the available settlement and funerary evidence and presented aggregate networks for the BF, PF 1, and PF 2. Additionally, whenever possible I reconstructed and analyzed subset-specific networks. Although the underlying datasets present many challenges, patterns of structural plausibility and association between cores and independently defined groupings of burials suggest that the reconstructed networks encode key information concerning spatial variability in mortuary vernaculars. Consequently, chapter 7 used summary measures extracted from the phase-specific aggregate networks to evaluate three aspects of the BF-PF transition emphasized in current reconstructions: 1) the degree of local and regional coordination at the root of the dramatic event of settlement reconfiguration between the BF 3 and PF 1; 2) the impact of shifting patterns of long-distance exchange on the trajectories of individual spatial subsets; and 3) the relationship between the formal characteristics and substance of the PF 1 centers.

To begin with, according to the evidence presented in section 7.2 the PF centers appear to have formed through an organic process of relocation across both northern and southern TCI rather than centrally planned multi-community moves. Differences between intra- and inter-subset distributions of edge weights for the BF 3 are indicative of a locally oriented relational landscape. In the potentially earlier PF 1 horizon represented by cremations, these differences are eroded completely, pointing to high degree of heterogeneity within the new centers.

Subsequently, the system seems to stabilize in the direction of BF 3 patterns.

Second, axes of long-distance exchange may have been anchored to rather than driven local patterns of interaction (section 7.3). In particular, the development of inter-subset affinities over the course of the PF 1 implies that the organic process of settlement reconfiguration established the foundations for an inland corridor across the Tiber prior the intensification of contacts with settlers and traders from the eastern Mediterranean. The circulation of metal resources and exotica at the interregional level may well have been historically important, as assumed by most reconstructions, but it probably did not play a determining role in shaping the trajectories of individual centers.

These results call into question the widespread characterization of developments within southern TCI as delayed and on the whole smaller in scale compared to the north. With regard to the third issue, therefore, it is not surprising that measures extracted from the PF 1 cremation network raise the possibility that formally different centers across TCI hosted comparable populations (section 7.4). In light of the substantial independent evidence for increasing levels of conflict over the course of the Bronze Age, variability in the estimated areas of PF 1 settlements can perhaps be explained in reference to the defensive potential of the underlying geomorphologies. Topographic features that were both extensive and naturally well demarcated, such the volcanic plateaus occupied by many of the northern centers, may have supported lower settlement densities without requiring substantially greater social and material investment in defensive measures.

In fact, applying an inverse scale of settlement density in relation to surface area yields comparable population figures for both northern and southern PF 1 centers, which is a plausible outcome in light of the similar starting conditions and pressures attested throughout the research area in the BF. Even more interesting, these hypothetical figures can potentially be understood in terms of qualitative changes in decision-making structures. The averages for BF villages hover close to 500 individuals, while those for the PF 1 are just above 2500. Following a long line of observations regarding the significance of such population figures, I argued that decision-making within BF communities could have extended to all adults or at least an individual from each nuclear family, while in the centers of the PF 1 it may have been restricted to representatives

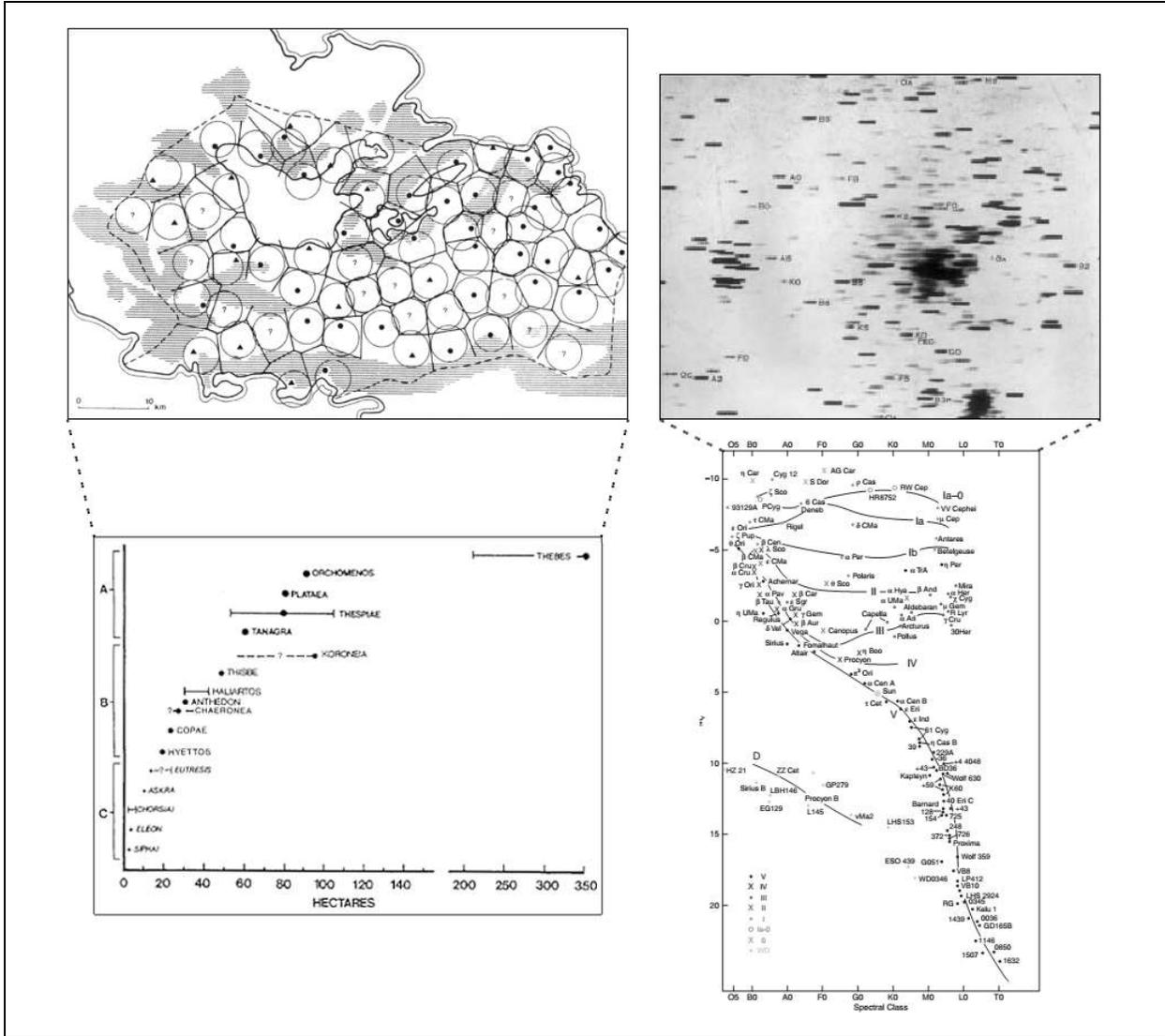
from each extended family. At least initially, a shift of this sort would have maintained decision-making efficiency within the larger settlements without extending power inequalities beyond the level of close kin.

Taken together, these observations recast late-prehistoric TCI as a highly dynamic context. Materialist approaches to the BF-PF transition essentially envision a steady march toward increasing power asymmetries (cf. section 2.1). In contrast, trajectories within the hypothesized vernacular plane paint a picture of groups testing the boundaries of their physical and relational landscape in order to better confront currents of conflict without relinquishing representative participation in decision-making. From this perspective, TCI becomes an interesting case study to better understand the frequently observed link between intensifying conflict and the emergence of large social collectives (e.g., Carneiro 1970; Flannery and Marcus 2003; Spencer 2003; Wright 2006).

Despite these encouraging results, much more work is required to establish the validity and broader anthropological utility of the theoretical and methodological approaches explored in this thesis. In the short term, additional results from the pilot isotopic study of mobility patterns will allow for more detailed assessments of the relational significance of p_{ij} averages and other summary measures extracted from the reconstructed networks. Just as important, the forthcoming publication of the well excavated cemeteries of Castiglione and Villa Bruschi Falgari, associated respectively with the Gabii and Tarquinia subsets, should provide suitable data to evaluate my claim that the low average numbers of clay objects attested at several burial grounds may reflect preservation and documentation biases.

At a more general level, it is important to explore other areas of the TCI relational space. As stressed in the introductory chapters, although mortuary vernaculars represent an appropriate starting point, useful bases for categorization can only be obtained by defining, validating, and analyzing multiple relational planes. Through such work, it may ultimately be possible to understand TCI as a context of eventful trajectories without abandoning the goal of systematic comparison and explanation.

FIGURE 8.1 Comparison of alternative approaches to the study of discontinuities and associated classificatory schemes (top left: 'proto-polis' network model for the region of Boeotia in Greece during the Archaic period; Bintliff 1999:18, fig. 3; bottom left: comparison of major urban sites within the same region during the subsequent Classical period, with surface area on the horizontal axis and three hypothesized 'status' classes on the vertical axis; Bintliff 1999:24, fig. 9; top right: 1893 objective prism plate showing spectra of individual stars; Hoffleit 2002:375, fig. 4; bottom right: Hertzsprung-Russell diagram illustrating the organization of stellar classes based on spectral type and absolute magnitude, respectively on the horizontal and vertical axes; the line at center-left corresponds to white dwarfs, the diagonal across the plot to main-sequence stars, and the horizontal lines at the top to subgiants, giants, and supergiants; adapted from Dick 2013:102, fig. 4.3, originally from Kaler 2006).



BIBLIOGRAPHY

- Acconcia, V., and G. Bartoloni 2014 La cittadella di Piazza d'Armi. *Rendiconti della Pontificia Accademia romana d'archeologia* 86:273-353.
- Adams, R. McC. 1966 *The Evolution of Urban Society: Early Mesopotamia and Prehispanic Mexico*. Chicago: Aldine.
- Adar, E., D. Weld, B. Bershad, and S. Gribble 2007 Why We Search: Visualizing and Predicting User Behavior. *In* WWW '07 Proceedings of the 16th international conference on World Wide Web. Pp. 161-170. New York: ACM.
- Albertoni, M. 2001 L'attività siderurgica nel Giardino Romano. *Bullettino della Commissione Archeologica Comunale di Roma* 102:357-358.
- Alessandri, L. 2013 *Il Latium Vetus nell'età del Bronzo e nella prima età del Ferro*. Oxford: Archaeopress.
- Ampolo, C. 1983. Sulla formazione della città di Roma. *Opus* 2:425-430.
- Ancient World Mapping Center 2012 *Antiquity À-la-carte*. Electronic resource, accessed May 18, 2016. <http://awmc.unc.edu/awmc/applications/alacarte>
- Anderson, D. G. 1994 *The Savannah River Chiefdoms: Political Change in the Late Prehistoric Southeast*. Tuscaloosa: University of Alabama Press.
- Andris, C., D. Lee, C. E. Gunning, J. A. Selden, and M. J. Hamilton 2013 *The Rise of Partisanship in the U.S. House of Representatives*. Santa Fe Institute Working Paper 2013-11-037.
- Antonucci, R. 1993 Unified Models for Active Galactic Nuclei and Quasars. *Annual Review of Astronomy and Astrophysics* 31:473-521.
- Arancio, M. L., and L. D'Erme 1991 Una tomba del Bronzo Finale da Cerveteri: Nuovi dati per la conoscenza del territorio. *Origini* 15:303-318.
- Attema, P., G.J. Burgers, and M. van Leusen 2010 *Regional Pathways to Complexity: Settlement and Landscape Dynamics in Italy in the 1st Millennium BC*. Amsterdam: Amsterdam University Press.
- Aynaud, T., and J.-L. Guillaume 2010 Static community detection algorithms for evolving networks. *In* WiOpt '10: Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks. Pp.508-514. Washington: CPS.
- Babbi, A. 2005 L'insediamento protostorico di Isola Farnese: Considerazioni sull'età del Bronzo finale nel distretto veiente. *In* *Dinamiche di sviluppo delle città nell'Etruria meridionale: Veio, Caere, Tarquinia, Vulci*. Pp.715-736. Rome: Istituti Editoriali e Poligrafici Internazionali.

- Barabási, A.-L., and R. Albert 2002 The Statistical Mechanics of Complex Networks. *Reviews of Modern Physics* 74:47-97.
- Barbaro, B. 2010 *Insedimenti, aree funerarie ed entità territoriali in Etruria meridionale nel Bronzo finale*. Florence: All'Insegna del Giglio.
- Barbaro, B., M. Bettelli, I. Damiani, D. De Angelis, C. Minniti, and F. Trucco 2012 Etruria meridionale e Mediterraneo nella tarda età del bronzo. *In Le origini degli Etruschi: Storia, Archeologia, Antropologia*. V. Bellelli, ed. Pp. 195-247. Rome: L'Erma di Bretschneider.
- Bartoloni, G. 1984 Riti funerari dell'aristocrazia in Etruria e nel Lazio: L'esempio di Veio. *Opus* 3:13-29.
- Bartoloni, G. 1989 *La cultura Villanoviana: All'inizio della storia Etrusca*. Rome: La nuova Italia Scientifica.
- Bartoloni, G. 2003a *Le società dell'Italia primitiva: Lo studio delle necropoli e la nascita delle aristocrazie*. Rome: Carocci.
- Bartoloni, G. 2003b Una cappella funeraria al centro del pianoro di Piazza d'Armi-Veio. *AION* 9-10:63-78.
- Bartoloni, G. 2012 I primi abitanti di Veio: L'insediamento di Isola Farnese. *In Il nuovo museo dell'agro veientano a Palazzo Chigi di Formello*. I. van Kampen, ed. Pp. 47-50. Rome: Quasar.
- Bartoloni, G., and F. Delpino, eds. 2005 *Oriente e Occidente: Metodi e discipline a confronto—Riflessioni sulla cronologia dell'età del ferro in Italia*. Pisa: Istituti Editoriali e Poligrafici.
- Bartoloni, G., and V. Nizzo, eds. 2005 *Lazio protostorico e mondo greco: Considerazioni sulla cronologia relativa e assoluta della terza fase laziale*. *In Oriente e Occidente: Metodi e discipline a confronto—Riflessioni sulla cronologia dell'età del ferro in Italia*. G. Bartoloni and F. Delpino, eds. Pp. 409-436. Pisa: Istituti Editoriali e Poligrafici.
- Bartoloni, G., M. Cataldi Dini, and F. Zevi 1982 *Aspetti dell'ideologia funeraria nella necropoli di Castel di Decima*. *In La mort, les morts dans les sociétés anciennes*. G. Gnoli and J.-P. Vernant, eds. Pp. 257-273. Cambridge: Cambridge University Press.
- Bartoloni, G., V. Acconcia, B. Bellelli Marchesini, F. Biagi, O. Cerasuolo, S. Neri, F. Pitzalis, L. Pulcinelli, and D. Sarracino 2013 *Progetto Veio: Novità dalle ultime campagne di scavo*. *Scienze dell'Antichità* 19:133-156.
- Bastianelli, S. 1942 Il territorio tolfetano nell'antichità. *Studi Etruschi* 16:229-260.
- Bates, S. J., J. Trostle, W. T. Cevallos, A. Hubbard, and J. N. S. Eisenberg 2007 Relating Diarrheal Disease to Social Networks and the Geographic Configuration of Communities in Rural Ecuador. *American Journal of Epidemiology* 166:1088-1095.
- Baumgartner, T., T. R. Burns, and P. DeVille 1986 *Shaping of Socio-Economic Systems: The Application of the Theory of Actor-System Dynamics to Conflict, Social Power, and Institutional Innovation in Economic Life*. London: Gordon and Breach.
- Becker, J. A., and J. Nowlin 2011 *Orientalizing Infant Burials from Gabii, Italy*. *BABESCH* 86:27-39.
- Becker, J. A., M. Mogetta, and N. Terrenato 2009 *A New Plan for an Ancient Italian City: Gabii*

- Revealed. *American Journal of Archaeology* 113:629-642.
- Becker, M. J., and L. Salvadei 1992 The Human Skeletal Remains from the Cemetery of Osteria dell'Osa. *In* La necropoli laziale di Osteria dell'Osa. A. M. Bietti Sestieri, ed. Pp. 53-191. Rome: Quasar.
- Belardelli, C., M. Angle, F. di Gennaro, and F. Trucco 2007 Repertorio dei siti protostorici del Lazio: Province di Roma, Viterbo e Frosinone. Florence: All'Insegna del Giglio.
- Belardelli, C., M. Bettelli, F. Campus, S. Cosentino, D. De Angelis, T. Di Fraia, F. di Gennaro, V. Leonelli, A. Mandolesi, G. Mieli, P. Tamburini, and A. Zifferero 1999 Il Bronzo finale e la prima età del Ferro nell'Italia centrale. *In* Criteri di nomenclatura e di terminologia inerente alla definizione delle forme vascolari del Neolitico-Eneolitico e del Bronzo-Ferro. D. Cocchi Genick, ed. Pp. 403-428. Florence: Octavo.
- Bell, C. M. 1992 *Ritual Theory, Ritual Practice*. New York: Oxford University Press.
- Bentley, R. A. 2006 Strontium Isotopes: From Earth to Archaeological Skeleton. *Journal of Archaeological Method and Theory* 13:135-187.
- Bentley, R. A., and C. Knipper 2005 Geographical Patterns in Biologically Available Strontium, Carbon and Oxygen Isotope Signatures in Prehistoric SW Germany. *Archaeometry* 47:629-644.
- Berardinetti, A., A. De Santis, and L. Drago 1997 Burials as Evidence for Proto-Urban Development in Southern Etruria: The Case of Veii. *Acta Hyperborea* 7:317-342.
- Berardinetti, A., and L. Drago 1997 La necropoli di Grotta Gramiccia. *In* Le necropoli arcaiche di Veio. G. Bartoloni, ed. Pp. 39-61. Rome: Università degli Studi di Roma "La Sapienza".
- Bernardi, F., J. J. González, and M. Requena 2007 The Sociology of Social Structure. *In* 21st Century Sociology: A Reference Handbook. B. Bryant and D. Peck, eds. Pp. 162-170. Thousand Oaks: Sage.
- Bettelli, M. 1997 Roma, la città prima della città: I tempi di una nascita—La cronologia delle sepolture ad inumazione di Roma e del Lazio nella prima età del ferro. Rome: L'Erma di Bretschneider.
- Bietti Sestieri, A. M. 1981 Produzione e scambio nell'Italia protostorica: Alcune ipotesi sul ruolo dell'industria metallurgica nell'Etruria mineraria alla fine dell'età del bronzo. *In* L'Etruria mineraria. Pp. 223-264. Florence: L. A. Olschki.
- Bietti Sestieri, A. M. 1985 Rapporti e scambi fra le genti indigene fra l'età del bronzo e la prima età del ferro nelle zone della colonizzazione. *In* Magna Grecia. G. Pugliese Carratelli, ed. Pp. 85-126. Milan: Electa.
- Bietti Sestieri, A. M., ed. 1992a La necropoli laziale di Osteria dell'Osa. Rome: Quasar.
- Bietti Sestieri, A. M. 1992b The Iron Age Community of Osteria dell'Osa: A Study of Socio-Political Development in Central Tyrrhenian Italy. Cambridge: Cambridge University Press.
- Bietti Sestieri, A. M. 1996 *Protostoria: Teoria e pratica*. Rome: Carocci.
- Bietti Sestieri, A. M. 2005 A Reconstruction of Historical Processes in Bronze and Early Iron Age Italy Based on Recent Archaeological Research. *In* Communities and Settlements from the Neolithic to the Early Medieval Period. P. Attema, A. Nijboer, and A. Zifferero, eds. Pp.

- 9-24. Oxford: Oxford University Press.
- Bietti Sestieri, A. M., ed. 2006 *Materie prime e scambi nella preistoria italiana*. Florence: Istituto Italiano di Preistoria e Protostoria.
- Bietti Sestieri, A. M. 2008 *Domi Mansit, Lanam Fecit: Was That All? Women's Status and Roles in the Early Latial Communities (11th-9th centuries BC)*. *Journal of Mediterranean Archaeology* 21:133-159.
- Bietti Sestieri, A. M. 2009 *Il Bronzo finale in Italia*. *Padusa* 44:7-54.
- Bietti Sestieri, A. M. 2010 *L'Italia nell'età del bronzo e del ferro: Dalle palafitte a Romolo (2200-700 a.C.)*. Rome: Carocci.
- Bietti Sestieri, A. M. 2011 *Archeologia della morte fra età del Bronzo ed età del Ferro in Italia: Implicazioni delle scelte relative alla sepoltura in momenti di crisi o di trasformazione politico-organizzativa*. *In Dalla nascita alla morte: Antropologia e archeologia a confronto*. V. Nizzo, ed. Pp. 397-417. Rome: E.S.S.
- Bietti Sestieri, A. M., and A. De Santis 2000 *Protostoria dei popoli latini*. Rome: Electa.
- Bietti Sestieri, A. M., A. De Santis, and L. Salvadei 2002 *L'abitato e la necropoli del lago di Castiglione (Roma)*. *In Paesaggi d'acque*. N. N. Catacchio, ed. Pp. 217-227. Milan: Centro Studi di Preistoria e Archeologia.
- Bietti Sestieri, A. M., A. De Santis, and L. Salvadei 2004 *Dati archeologici e analisi paleobiologiche relativi alle comunità della prima età del Ferro laziale di Osteria dell'Osa e di Castiglione*. *Rivista di Scienze Preistoriche* 54:538-553.
- Bietti Sestieri, A. M., and A. De Santis 2007 *Il Lazio antico fra tarda Età del Bronzo e prima Età del Ferro: Gli sviluppi nell'organizzazione politico-territoriale in relazione con il processo di formazione urbana*. *In Strategie di insediamento fra Lazio meridionale e Campania centro-settentrionale in età protostorica*. D. Cocchi Genick, ed. Pp. 205-230. Florence: Istituto Italiano di Preistoria e Protostoria.
- Bietti Sestieri, A. M., and A. De Santis 2008 *Relative and Absolute Chronology of Latium Vetus from the Late Bronze Age to the Transition to the Orientalizing Period*. *In A New Dawn for the Dark Age? Shifting Paradigms in Mediterranean Iron Age Chronology*. D. Brandherm and M. Trachsel, eds. Pp. 119-133. Oxford: Archaeopress.
- Bietti Sestieri, A. M., and A. De Santis 2012 *Elementi di continuità rituale in Etruria meridionale, Lazio e Campania fra l'età del bronzo finale e la prima età del ferro*. *In L'Etruria dal Paleolitico al Primo Ferro: Lo stato delle ricerche*. N. Negroni Catacchio, ed. Pp. 635-650. Milan: Centro Studi di Preistoria e Archeologia.
- Bietti, A., ed. 1996 *Theoretical and Methodological Problems*. Forlì: A.B.A.C.O.
- Binford L. R. 1971 *Mortuary Practices: Their Study and Potential*. *In Approaches to the Social Dimensions of Mortuary Practices*. J. Brown, ed. Society for American Archaeology, *Memoir* 25:6-29.
- Bintliff, J. 1999 *Pattern and Process in the City Landscape of Boeotia from Geometric to Late Roman Times*. *In Territoires des cites grecques*. M. Brunet, ed. Pp. 15-33. Paris: de Boccard.
- Blau, P. M. 1964 *Exchange and Power in Social Life*. New Brunswick: Transaction Publishers.

- Blau, P. M. 1977 *Inequality and Heterogeneity*. New York: Free Press.
- Blau, P. M. 1980 A Fable about Social Structure. *Social Forces* 58:777-788.
- Blau, P. M. 1989 Structures of Social Positions and Structures of Social Relations. *In Theory Building in Sociology*. J. Turner, ed. Pp. 43-59. London: Sage.
- Blondel, V. D., J.-L. Guillaume, R. Lambiotte, and E. Lefebvre 2008 Fast Unfolding of Communities in Large Networks. *Journal of Statistical Mechanics: Theory and Experiment* P10008.
- Blonder, B., T. W. Wey, A. Dornhaus, R. James, and A. Sih 2012 Temporal Dynamics and Network Analysis. *Methods in Ecology and Evolution* 3:958-972.
- Boatwright, M. T., D. J. Gargola, and R. J. A. Talbert 2004 *The Romans: From Village to Empire*. New York: Oxford University Press.
- Boccaletti, S., V. Latora, Y. Moreno, M. Chavez, and D. U. Hwang 2006 Complex Networks: Structure and Dynamics. *Physics Reports* 424:175–308.
- Boccuccia, F. 2001 Livelli di occupazione del Bronzo nel Giardino Romano: Il Bronzo finale. *Bullettino della Commissione Archeologica di Roma* 102:299-306.
- Bohannon, P. J., and G. Dalton 1962 *Markets in Africa*. Evanston: Northwestern University Press.
- Boitani, F., S. Neri, and F. Biagi 2008 La donna delle fornaci di Veio-Campetti. *Scienze dell'Antichità* 14:89-124.
- Bonghi Jovino, M. 2005 Offerte, uomini e dei nel 'complesso monumentale' di Tarquinia: Dallo scavo all'interpretazione. *In Offerte dal regno vegetale e dal regno animale nelle manifestazioni del sacro*. M. Bonghi Jovino, ed. Pp. 73-89. Rome: L'Erma di Bretschneider.
- Bonghi Jovino, M. 2009 A proposito del bambino epilettico di Tarquinia: Una rivisitazione. *Athenaeum* 97:471-476.
- Bonghi Jovino, M. 2010 The Tarquinia Project: A Summary of 25 Years of Excavation. *American Journal of Archaeology* 114:161-180.
- Bonghi Jovino, M., and C. Chiaramonte Treré, eds. 1997 *Tarquinia: Testimonianze archeologiche e ricostruzione storica—Scavi sistematici nell'abitato (Campagne 1982-1988)*. Rome: L'Erma di Bretschneider.
- Bornholdt, S., and T. Rohlf 2000 Topological Evolution of Dynamical Networks: Global Criticality from Local Dynamics. *Physical Review Letters* 84:6114-6117.
- Braswell, G. E., C. M. Prager, C. R. Bill, S. A. Schwake, and J. B. Braswell 2004 The Rise of Secondary States in the Southeastern Periphery of the Maya World: A Report on Recent Archaeological and Epigraphic Research at Pusilha, Belize. *Ancient Mesoamerica* 15:219-233.
- Brock, A. 2016 Envisioning Rome's Prehistoric River Harbor: An Interim Report from the Forum Boarium. *Etruscan Studies* 19:1-22.
- Brown, J. A. 1971 The Dimensions of Status in the Burials at Spiro. *In Approaches to the Social Dimensions of Mortuary Practices*. J. Brown, ed. Society for American Archaeology,

Memoir 25:92-112.

- Brown, J. A. 1981 The Search for Rank in Prehistoric Burials. *In* *The Archaeology of Death*. R. Chapman, I. Kinnes, and K. Randsborg, eds. Pp. 25-37. Cambridge: Cambridge University Press.
- Brown, J. A. 1995 On Mortuary Analysis—with Special Reference to the Saxe-Binford Research Program. *In* *Regional Approaches to Mortuary Analysis*. L. A. Beck, ed. Pp. 3-26. New York: Plenum Press.
- Brughmans, T. 2010 Connecting the Dots: Towards Archaeological Network Analysis. *Oxford Journal of Archaeology* 29:277-303.
- Brughmans, T. 2013 Thinking Through Networks: A Review of Formal Network Methods in Archaeology. *Journal of Archaeological Method and Theory* 20: 623-662
- Brusadin Laplace, D. 1964 Le necropoli protostoriche del Sasso di Furbara, I: La necropoli ai Puntoni. *Bullettino di Paletnologia Italiana* 73:148-186.
- Buranelli, F. 1983 La necropoli villanoviana “Le Rose” di Tarquinia. Città di Castello: Consiglio Nazionale delle Ricerche.
- Buranelli, F., L. Drago, and L. Paolini 1997 La necropoli di Casale del Fosso. *In* *Le necropoli arcaiche di Veio*. G. Bartoloni, ed. Pp. 63-83. Rome: Università degli Studi di Roma “La Sapienza”.
- Burgess, M., E. Adar, and M. Cafarella 2015 Link-Prediction Enhanced Consensus Clustering for Complex Networks. arXiv 1506.01461.
- Campigotto, R., and J.-P. Guillaume 2015 The Power of Consensus: Random Graphs Still Have No Communities. *In* *Social Network Analysis—Community Detection and Evolution*. R. Missaoui and I. Sarr, eds. Pp. 145-164. New York: Springer.
- Carafa, P. 2008 Uccisioni rituali e sacrifici umani nella topografia di Roma. *Scienze dell’Antichità* 14:667-704.
- Carandini, A. 1997 *La nascita di Roma: Dèi, lari, eroi e uomini all’alba di una civiltà*. Turin: Einaudi.
- Carandini, A., and P. Carafa, eds. 2000 *Palatium e Sacra Via, I*. Rome: Istituto Poligrafico e Zecca dello Stato.
- Cardarelli, A. 1997 The Evolution of Settlement and Demography in the Terramare Culture. *In* *Demographie der Bronzezeit*. K. F. Ritterschoffer, ed. Pp. 230-237. Espelkamp: Leidorf.
- Cardosa, M. 2004 Alle origini degli Etruschi: Da Sorgenti della Nova e Sovana a Vulci. *In* *Sviluppi recenti nell’antichistica: Nuovi contributi*. V. De Angelis, ed. Pp. 257-263. Milan: Cisalpino.
- Carneiro, R. L. 1970 A Theory of the Origin of the State. *Science* 169:733-738.
- Cascino, R., H. Di Giuseppe, and H. L. Patterson 2012 *Veii: The Historical Topography of the Ancient City*. London: British School at Rome.
- Catalano, P., C. Cavazzuti, A. Celant, F. De Angelis, A. De Santis, R. Freeman, D. Magri, G. Mieli, C. Minniti, W. B. Pantano 2014 *Analisi contestuale di alimentazione e salute nel Lazio*

- nella I età del Ferro (II periodo laziale, ca. X-IX sec. a.C.). Paper presented at the 50ma Riunione Scientifica dell'Istituto Italiano di Preistoria e Protostoria, Rome, October 5-9.
- Cazzella, A. 2001 Sviluppi verso l'urbanizzazione a Roma alla luce dei recenti scavi nel Giardino Romano. *Bullettino della Commissione Archeologica Comunale di Roma* 102:265-268.
- Cazzella, A., I. Baroni, P. Boccuccia, F. Lugli, and D. Tabò 2007 Testimonianze della media età del Bronzo sul Campidoglio. *In Strategie di insediamento fra Lazio meridionale e Campania centro-settentrionale in età protostorica*. D. Cocchi Genick, ed. Pp. 803-814. Florence: Istituto Italiano di Preistoria e Protostoria.
- Cerasuolo, O. 2008 All'origine di Caere: Contributo alla conoscenza del processo formativo protourbano in un settore dell'Etruria meridionale. *In Paesaggi reali e paesaggi mentali*. C. N. Negrone Catacchio, ed. Pp. 683-697. Milan: Centro Studi di Preistoria e Archeologia.
- Chakraborty, T., S. Srinivasan, N. Ganguly, S. Bhowmick, and A. Mukherjee 2013 Constant Communities in Complex Networks. *Scientific Reports* 3:1825.
- Chapman, R. W. 2003 *Archaeologies of Complexity*. Routledge: London.
- Cheng, J., L. Adamic, P. A. Dow, J. Kleinberg, and J. Leskovec 2014 Can Cascades be Predicted? *In WWW '14 Proceedings of the 23rd International Conference on World Wide Web*. Pp. 925-936. New York: ACM.
- Christiansen, K., and D. Levinson, eds. 2003 *Encyclopedia of Community: From the Village to the Virtual World*. Thousand Oaks: Sage Publications.
- Clauset, A., C. Moore, and M. Newman 2008 Hierarchical Structure and the Prediction of Missing Links in Networks. *Nature* 453:98-101.
- Cocchi Genick, D., ed. 1999 *Criteri di nomenclatura e di terminologia inerente alla definizione delle forme vascolari del Neolitico-Eneolitico e del Bronzo-Ferro*. Florence: Octavo.
- Colini, G. A. 1911 Le antichità di Tolfa e Allumiere e il principio della età del ferro in Italia. *Bullettino di Paleontologia Italiana* 36:96-149
- Colonna G., 1974. Preistoria e protostoria di Roma e del Lazio. *In Popoli e civiltà dell'Italia antica*. B. D'Agostino, P. E. Arias, and G. Colonna, eds. Pp. 272-346. Rome: Biblioteca di storia patria.
- Colonna, G., ed. 1976. *Civiltà del Lazio primitivo*. Rome: Multigrafica.
- Colonna, G. 1988 I Latini e gli altri popoli del Lazio. *In Italia Omnium Terrarum Alumna*. Pp. 411-530. Milan: Scheiwiller.
- Cornell, T. J. 1995 *The Beginnings of Rome: Italy and Rome from the Bronze Age to the Punic Wars (c. 1000-264 BC)*. London: Routledge.
- Cowan, G. A., D. Pines, and D. Meltzer 1994 *Complexity: Metaphors, Models, and Reality*. Reading: Addison-Wesley.
- Cowgill, G. L. 2004 Origins and Development of Urbanism: Archaeological Perspectives. *Annual Review of Anthropology* 33:525-549.
- Cristofani, M., G. Nardi, M. A. Rizzo 1988 *Caere 1: Il parco archeologico*. Rome: Consiglio

Nazionale dell Ricerche.

- Crumley, C. L. 1995 Heterarchy and the Analysis of Complex Societies. *Archaeological Papers of the American Anthropological Association* 6:1-5.
- Cuomo Di Caprio, N. 1992 Studio tecnologico e analisi di microscopia ottica di 63 campioni ceramici dalla necropoli di Osteria dell'Osa. *In La Necropoli laziale di Osteria dell'Osa*. A. M. Bietti Sestieri, ed. Pp. 449-478. Rome: Quasar.
- D'Ercole, V. 1995 Ripresa degli scavi nella necropoli protovillanoviana di Poggio della Pozza ad Allumiere (Roma). *In Tipologia delle necropoli e rituali di deposizione*. N. Negroni Catacchio, ed. Pp. 177-186. Milan: Centro Studi di Preistoria e Archeologia.
- D'Ercole, V. 1998 Poggio della Pozza, Allumiere: Campagna di scavo 1994. *In Protovillanoviani e/o protoetruschi*. N. Negroni Catacchio, ed. Pp. 181-192. Milan: Centro Studi di Preistoria e Archeologia.
- Danckers, J. 2014 Protostoria italiana e marxismo nell'Italia del secondo dopoguerra. *In 150 anni di preistoria e protostoria in Italia*. A. Guidi, ed. Pp. 497-501. Florence: Istituto Italiano di Preistoria e Protostoria.
- Danon, L., A. Díaz-Guillera, J. Duch, and A. Arenas 2005 Comparing Community Structure Identification. *Journal of Statistical Mechanics: Theory and Experiment* P09008.
- Davenport, E.C., and N. A. El-Sanhurry 1991 Phi/Phimax: Review and Synthesis. *Educational and Psychological Measurement* 51:821-828.
- De Agostino, A., J. B. Ward Perkins, R. A. Staccioli, A. P. Vianello, D. Ridgway, J. Close-Brooks, and M. T. Amorelli Falconi 1963 Veio (Isola Farnese): Scavi in una necropoli villanoviana in località "Quattro Fontanili". *Notizie degli Scavi* 17:77-272.
- De Angelis, S. 2006 Il passaggio tra Bronzo finale 2 e Bronzo finale 3 in Etruria meridionale sotto il profilo delle sepolture. *In Studi di protostoria in onore di Renato Peroni*. Pp. 581-589. Florence: All'Insegna del Giglio.
- De Grossi Mazzorin, J. 2004 Some Considerations about the Evolution of the Animal Exploitation in Central Italy from the Bronze Age to the Classical Period. *In Pecus: Man and Animal in Antiquity*. B. S. Frizell, ed. Pp. 38-49. Rome: Swedish Institute in Rome.
- De Santis, A. 2001a Castiglione: Abitato dell'età del Bronzo e necropoli dell'età del Ferro. *In Archeologia e Giubileo: Gli interventi a Roma e nel Lazio nel piano per il Grande Giubileo del 2000*. F. Filippi, ed. Pp. 485-489. Naples: Electa.
- De Santis, A. 2001b. Le sepolture di età protostorica a Roma. *Bullettino della Commissione Archeologica Comunale di Roma* 102:269-280.
- De Santis, A. 2005 A Research Project on the Earliest Phases of the Latial Culture. *In Communities and Settlements from the Neolithic to the Early Medieval Period*. P. Attema, A. Nijboer, and A. Zifferero, eds. Pp. 156-163. Oxford: Oxford University Press.
- De Santis, A. 2008 Il Lazio antico fra l'età del bronzo finale e la prima età del ferro. *In Museo e territorio*. M. Angle, A. Germano, and U. Nicosia, eds. Pp. 198-209. Rome: Bonsignori Editore.
- De Santis, A., O. Colacicchi, M. R. Giuliani, B. Santoro 2010a Il processo storico nel Lazio

- antico tra la tarda età del Bronzo e la prima età del Ferro: I protagonisti. *In* L'alba dell'Etruria: Fenomeni di continuità e trasformazione nei secoli XII-VIII a.C. N. Negroni Catacchio, ed. Pp. 311-323. Milan: Centro Studi di Preistoria e Archeologia.
- De Santis, A., G. Mieli, C. Rosa, R. Matteucci, A. Celant, C. Minniti, P. Catalano, F. De Angelis, S. Di Giannantonio, C. Giardino, and P. Giannini 2010b Le fasi di occupazione nell'area centrale di Roma in età protostorica: Nuovi dati dagli scavi nel Foro di Cesare. *Scienze dell'Antichità* 16:259-284.
- de Solla Price, D. J. 1965 Networks of Scientific Papers. *Science* 149:510-515.
- Delpino, F. 1977 La prima età del ferro a Bisenzio—Aspetti della cultura villanoviana nell'Etruria meridionale interna. *Memorie della Classe di Scienze morali e storiche dell'Accademia dei Lincei* 21:453-493.
- Delpino, F. 1982 Saggi di scavo sul Monte Bisenzio. *In* *Archeologia nella Tuscia*. Pp. 153-157. Rome: Consiglio Nazionale delle Ricerche.
- Delpino, F. 1995 Strutture tombali nell'Etruria meridionale villanoviana. *In* *Tipologia delle necropoli e rituali di deposizione*. N. Negroni Catacchio, ed. Pp. 217-224. Milan: Centro Studi di Preistoria e Archeologia.
- di Gennaro, F. 1982 Organizzazione del territorio nell'Etruria meridionale protostorica: Applicazione di un modello grafico. *Dialoghi di Archeologia* 2:102-112.
- di Gennaro, F. 1986 Forme di insediamento tra Tevere e Fiora dal bronzo finale al principio dell'età del ferro. Florence: L. S. Olschki.
- di Gennaro, F. 2004 Luni sul Mignone e San Giovenale (Blera, Viterbo). *In* *L'età del bronzo recente in Italia*. D. Cocchi Genick, ed. Pp. 121-124. Viareggio: M. Baroni.
- di Gennaro, F., R. Egidi, L. Alessandri, B. Barbaro, A. Di Renzoni, S. Favorito, C. Iaia, S. Sabatini, and A. Schiappelli 2005 Tenuta Quadraro—Via Lucrezia Romana (Roma): Ricerche su un comprensorio peri-insediativo della tarda età del Bronzo. *In* *Communities and Settlements from the Neolithic to the Early Medieval Period*. P. Attema, A. Nijboer, and A. Zifferero, eds. Pp. 666-672. Oxford: Oxford University Press.
- di Gennaro, F., R. Egidi, B. Barbaro, S. Favorito, E. Foddai, and C. Iaia 2007 Sepolcreti del Bronzo Finale tra Roma e i Colli Albani. *In* *Strategie di insediamento fra Lazio meridionale e Campania centro-settentrionale in età protostorica*. D. Cocchi Genick, ed. Pp. 815-826. Florence: Istituto Italiano di Preistoria e Protostoria.
- di Gennaro, F., and B. Barbaro 2008 Territori e paesaggi mediotirrenici nella mente dei protostorici. *In* *Paesaggi reali e paesaggi mentali*. C. N. Negroni Catacchio, ed. Pp. 117-128. Milan: Centro Studi di Preistoria e Archeologia.
- di Gennaro, F., and A. Guidi 2009a L'abitato protostorico di Monte Cavo (Rocca di Papa, Roma). *Lazio e Sabina* 5: 213-220.
- di Gennaro, F., and A. Guidi 2009b Ragioni e regioni di un cambiamento culturale: Modi e tempi della formazione dei centri protourbani nella valle del Tevere e nel Lazio meridionale. *Scienze dell'Antichità* 15:429-445.
- di Gennaro, F., and A. Amoroso 2010 La bassa valle del Tevere nel Primo Ferro: Formazione

- degli abitati e avvicendamento di assetti territoriali. *In* L'alba dell'Etruria: Fenomeni di continuità e trasformazione nei secoli XII-VIII a.C. N. Negroni Catacchio, ed. Pp. 299-309. Milan: Centro Studi di Preistoria e Archeologia.
- di Gennaro, F., and A. Guidi 2010 Lo stato delle anime come mezzo per la ricostruzione della popolazione dei villaggi protostorici. *Arqueología Espacial* 28:351-358.
- di Gennaro, F., and A. Schiappelli 2012 Ceramica della prima età del ferro: La ceramica d'impasto. *In* Veii: The Historical Topography of the Ancient City. R. Cascino, H. Di Giuseppe, and H. L. Patterson, eds. Pp. 85-101. London: British School at Rome.
- Dick, S. J. 2013 *Discovery and Classification in Astronomy: Controversy and Consensus*. New York: Cambridge University Press.
- Dietler, M. 2005 The Archaeology of Colonization and the Colonization of Archaeology: Theoretical Challenges from an Ancient Mediterranean Colonial Encounter. *In* The Archaeology of Colonial Encounters: Comparative Perspectives. G. Stein, ed. Pp. 33-68. Santa Fe: School for Advanced Research.
- Dunbar, R. I. M. 1992 Neocortex Size as a Constraint on Group Size in Primates. *Journal of Human Evolution* 22:469-493.
- Dunnell, R. C. 1992 The Notion Site. *In* Space, Time, and Archaeological Landscapes. J. Rossignol, ed. Pp. 21-41. New York: Plenum Press.
- Ebert, J. I. 1992 *Distributional Archaeology*. Albuquerque: University of New Mexico Press.
- Emerson, R. M. 1972 Exchange Theory, Part II: Exchange Relations and Networks. *In* Sociological Theories in Progress. J. Berger, M. Zelditch, and B. Anderson, eds. Pp. 58-87. Boston: Houghton Mifflin.
- Fantalkin, A., I. Finkelstein, and E. Piasezky 2011 Iron Age Mediterranean Chronology: A Rejoinder. *Radiocarbon* 53:179-198.
- Filippi, D. 2008 Dalla Domus Regia al Foro: Depositi di fondazione e di obliterazione nella prima età regia. *Scienze dell'Antichità* 14:617-638.
- Finley, M. I. 1977 *The Ancient City: From Fustel de Coulanges to Max Weber and Beyond*. *Comparative Studies in Society and History* 19:305-327.
- Flannery, K. V. 1972 The Cultural Evolution of Civilizations. *Annual Review of Ecology and Systematics* 3:399-426.
- Flannery, K. V. 1998 The Ground Plans of Archaic States. *In* Archaic States. G. M. Feinman and J. Marcus, eds. Pp. 15-57. Santa Fe: School of American Research.
- Flannery, K. V., and J. Marcus 2003 The Origin of War: New ¹⁴C Dates from Ancient Mexico. *Proceedings of the National Academy of Sciences* 100:11801-11805.
- Foley, W. A. 1988 Language Birth: The Processes of Pidginization and Creolization. *In* Language: The Socio-Cultural Context. F. J. Newmeyer, ed. Pp. 162-183. Cambridge: Cambridge University Press.
- Fornaciari, G., and F. Mallegni 1987 Il bambino della Civita: Un caso di probabile aneurisma venoso del IX secolo a. C. *In* Tarquinia: Ricerche, scavi e prospettive. M. Bonghi Jovino and C. Chiaramonte Treré, eds. Pp. 95-98. Milan: Edizioni ET.

- Fortunato, S. 2010 Community Detection in Graphs. *Physics Reports* 486:75-174.
- Fox, R. 1977 *Urban Anthropology: Cities in Their Cultural Setting*. Englewood Cliffs: Prentice-Hall.
- Frazer, J. G. 1890 *The Golden Bough: A Study in Comparative Religion*. London: Macmillan.
- Freeman, L. C. 2004 *The Development of Social Network Analysis: A Study in the Sociology of Science*. Vancouver, B. C.: Empirical Press.
- Freeman, L. C. 2008 Going the Wrong Way on a One-Way Street: Centrality in Physics and Biology. *Journal of Social Structure* 9(2).
- Fried, M. 1960 On the Evolution of Social Stratification and the State. *In Culture in History*. S. Diamond, ed. Pp. 713-731. New York: Columbia University Press.
- Fried, M. 1975 *The Notion of Tribe*. Menlo Park: Cummings.
- Fulminante, F. 2012 Social Network Analysis and the Emergence of Central Places: A Case Study from Central Italy (Latium Vetus). *BABESCH* 87:1-27.
- Fulminante, F. 2014 *The Urbanisation of Rome and Latium Vetus: From the Bronze Age to the Archaic Era*. New York: Cambridge University Press.
- Fulminante, F. and S. Stoddart 2010 Formazione politica a confronto in Etruria e Latium vetus: Status quaestionis e nuove prospettive di ricerca. *Bollettino di Archeologia Online* 1(F/F1/3):11-22.
- Ghirardini, G. 1881 Corneto—Tarquinia. *In Notizie degli Scavi di Antichità*, Gennaio 1881. Pp. 342-371. Rome: Salviucci.
- Gialanella, C. 2003 Pithekoussai. *In Sea Routes From Sidon to Huelva: Interconnections in the Mediterranean, 16th-6th c. BC*. N. C. Stampolidis, ed. Pp. 178-183. Athens: Museum of Cycladic Art.
- Giddens, A. 1976 *New Rules of Sociological Method: A Positive Critique of Interpretative Sociologies*. New York: Basic Books.
- Gierow, P. G. 1961 Notes on the Iron Age Chronology of Latium. *Opuscula Romana* 3:103-122.
- Gierow, P. G. 1964 *The Iron Age Culture of Latium*. Lund: C. W. K. Gleerup.
- Gjerstad, E. 1956 *Early Rome II: The Tombs*. Lund: C. W. K. Gleerup.
- Gjerstad, E. 1966 *Early Rome IV: Synthesis of Archaeological Evidence*. Lund: C. W. K. Gleerup.
- Gnesotto, F. 2006 Lo stadio “protourbano”: Aspetti mediotirrenici, confronti e considerazioni. *In Studi di protostoria in onore di Renato Peroni*. Pp. 743-753. Florence: All’Insegna del Giglio.
- Goldstein, L. 1976 *Spatial Structure and Social Organization: Regional Manifestations of Mississippian Society*. Ph. D. dissertation, Department of Anthropology, Northwestern University.
- Goodenough, W. 1970 *Description and Comparison in Cultural Anthropology*. Chicago: Aldine.
- Gosselain, O. P. 2008 Mother Bella was not a Bella: Inherited and Transformed Traditions in Southwestern Niger. *In Cultural Transmission and Material Culture: Breaking Down*

- Boundaries. M. T. Stark, B. J. Bowser, and L. Horne, eds. Pp. 150-177. Tucson: University of Arizona Press.
- Grandazzi, A. 1991 *La fondation de Rome*. Paris: Belles Lettres.
- Gross, T., and B. Blasius 2008 Adaptive Coevolutionary Networks: A Review. *Journal of the Royal Society Interface* 5:259-271.
- Gross, T., and H. Sayama 2009 *Adaptive Networks: Theory, Models, and Applications*. New York: Springer.
- Guaitoli, M. 1981 Gabii: Osservazioni sulle fasi di sviluppo dell'abitato. *In Ricognizione archeologica: Nuove ricerche nel Lazio*. Quaderni dell'Istituto di Topografia Antica della Università di Roma 9, 23-58.
- Guidi, A. 1982 *Sulle prime fasi dell'urbanizzazione nel Lazio protostorico*. *Opus* 1:279-288.
- Guidi, A. 1993 *La necropoli veiente dei Quattro Fontanili nel quadro della fase recente della prima età del ferro italiana*. Florence: Leo S. Olschki.
- Guidi, A. 2000a *Il Lazio e la Sabina tra la tarda età del Bronzo e l'età del Ferro*. *In Paesaggi di potere: Problemi e prospettive*. G. Camassa, A. De Guio, and F. Veronese, eds. Pp. 85-94. Rome: Quasar.
- Guidi, A. 2000b *Preistoria della complessità sociale*. Bari: Laterza.
- Guidi, A. 2002 *Modeling the Social Evolution: The State of Art*. *Archeologia e Calcolatori* 13:65-78.
- Guidi, A. 2006 *The Archaeology of Early State in Italy*. *Social Evolution and History* 6:55-90.
- Guidi, A., M. Pacciarelli, and F. di Gennaro 1978 *Rinvenimenti di età pre- e protostorica a Grottaferrata e a Monte Cavo*. *Archeologia Laziale* 1:84-86.
- Guimera, R., L. Danon, A. Diaz-Guilera, F. Giralt, and A. Arenas 2003 *Self-Similar Community Structure in a Network of Human Interactions*. *Physical Review E* 68:065103.
- Hansen, M. H. 2000 *A Comparative Study of Thirty City-State Cultures: An Investigation*. Copenhagen: Kongelige Danske Videnskabernes Selskab.
- Hansen, M. H. 2002 *A Comparative Study of Six City-State Cultures*. Copenhagen: C. A. Reitzels.
- Harris, M. 1976 *History and Significance of the Emic/Etic Distinction*. *Annual Review of Anthropology* 5:329-350.
- Hegmon, M. 2002 *Concepts of Community in Archaeological Research*. *In The Last Pueblo Communities of the Mesa Verde Region: Crow Canyon's Research at the Sand Canyon Locality*. R. H. Wilshusen and M. D. Varien, eds. Pp. 263-279. Salt Lake City: University of Utah Press.
- Hegmon, M. 2003 *Setting Theoretical Egos Aside: Issues and Theory in North American Archaeology*. *American Antiquity* 68:213-243.
- Heider, K. G. 1988 *The Rashomon Effect: When Ethnographers Disagree*. *American Anthropologist* 90:73-81.

- Helbig, W. 1882 Scavi di Corneto. *In* *Bullettino dell'Istituto di Corrispondenza Archeologica*, Gennaio e Febbraio 1882. Pp. 10-22. Rome: Salviucci.
- Hencken, H. 1968 Tarquinia, Villanovans, and Early Etruscans. Cambridge: Peabody Museum.
- Hirth, K. G. 1996 Political Economy and Archaeology: Perspectives on Exchange and Production. *Journal of Archaeological Research* 4:203-239.
- Hoffleit, E. D. 2002 Pioneering Women in the Spectral Classification of Stars. *Physics in Perspective* 4:370-398.
- Homans, G. C. 1964 Bringing Men Back in. *American Sociological Review* 29:809-818.
- Hric, D., R. K. Darst, and S. Fortunato 2014 Community Detection in Networks: Structural Communities versus Ground Truth. *Physical Review E* 90:062805.
- Humphreys, S. C. 1978 *Anthropology and the Greeks*. London: Routledge and Kegan Paul.
- Iaia, C. 1999 Simbolismo funerario e ideologia alle origini di una civiltà urbana: Forme rituali nelle sepolture "villanoviane" a Tarquinia e Vulci e nel loro entroterra. Florence: All'Insegna del Giglio.
- Iaia, C. 2000 Connessioni laziali e sabine nell'estremo sud dell'Etruria agli inizi del primo millennio a.C. *In* *L'Etruria tra Italia, Europa e mondo mediterraneo*. Pp. 505-507. Milan: Centro studi di preistoria e archeologia.
- Iaia, C., and A. Mandolesi 1993 Topografia dell'insediamento dell'VIII secolo a.C. in Etruria meridionale. *Journal of Ancient Topography* 3:17-47.
- Iaia, C., and A. Mandolesi 2010 Comunità e territori nel villanoviano evoluto dell'Etruria meridionale. *In* *L'alba dell'Etruria: Fenomeni di continuità e trasformazione nei secoli XII-VIII a.C.* N. Negroni Catacchio, ed. Pp. 61-78. Milan: Centro Studi di Preistoria e Archeologia.
- Iaia, C., and M. Pacciarelli 2012 La cremazione in area mediotirrenica tra bronzo finale e primo ferro. *In* *Necròpolis d'incineració entre l'Ebre i el Tíber (segles IX-VI aC): Metodologia, pràctiques funeràries i societat*. M.C. Rovira Hortalà, F.J. López Cachero, and F. Mazière, eds. Pp. 341-355. Barcelona: MAC.
- Ito, J., and K. Kaneko 2002 Spontaneous Structure Formation in a Network of Chaotic Units with Variable Connection Strengths. *Physical Review Letters* 88:028701.
- Jennings, H. H. 1943 *Leadership and Isolation: A Study of Personality in Interpersonal Relations*. New York: Longmans.
- Joffe, A. H. 2002 The Rise of Secondary States in the Iron Age Levant. *Journal of the Economic and Social History of the Orient* 45:425-467.
- Johnson, G. A. 1982 Organizational Structure and Scalar Stress. *In* *Theory and Explanation in Archaeology*. C. A. Renfrew, M. J. Rowland, and D. A. Segraves, eds. Pp. 389-421. New York: Academic Press.
- Kaler, J. B. 2006 *The Cambridge Encyclopedia of Stars*. Cambridge: Cambridge University Press.
- Killgrove K. 2010 Migration and Mobility in Imperial Rome. Ph.D. dissertation, Department of

- Anthropology, University of North Carolina.
- Kim, M., and J. Leskovec 2012 Multiplicative Attribute Graph Model of Real-World Networks. *Internet Mathematics* 8:113-160.
- Klitsche de la Grange, A. 1884 Allumiere: Rapporto sopra nuove scoperte di tombe antichissime in contrada della Pozza. *In* *Notizie degli Scavi di Antichità*, Gennaio 1884. Pp. 152-153. Rome: Salviucci.
- Knappett, C., ed. 2013 *Network Analysis in Archaeology: New Approaches to Regional Interaction*. Oxford: Oxford University Press.
- Kong, S., Q. Mei, L. Feng, F. Ye, and Z. Zhao 2015 Predicting Bursts and Popularity of Hashtags in Real-Time. *In* *Proceedings of the 37th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*. Pp. 927-930.
- Kosse, K. 1990 Group Size and Social Complexity: Thresholds in the Long-Term Memory. *Journal of Anthropological Archaeology* 9:275-303.
- Kosse, K. 2001 Some Regularities in Human Group Formation and the Evolution of Societal Complexity. *Complexity* 6:60-64.
- Kramer, C. 1982 *Village Ethnoarchaeology: Rural Iran in Archaeological Perspective*. New York: Academic Press.
- Kroeber, A. L. 1927 Disposal of the Dead. *American Anthropologist* 29:308-315.
- Kroeber, A. L. and T. Parsons 1958 The Concepts of Culture and of Social System. *American Sociological Review* 23:582-583.
- Kuehn, C., E. A. Martens, and D.M. Romero 2014 Critical Transitions in Social Network Activity. *Journal of Complex Networks* 2:141-152.
- Labov, W. 1972 Some Principles of Linguistic Methodology. *Language in Society* 1:97-120.
- Labov, W. 2014 The Role of African Americans in Philadelphia Sound Change. *Language Variation and Change* 26:1-19.
- Lancichinetti, A., and S. Fortunato 2012 Consensus Clustering in Complex Networks. *Scientific Reports* 2:336.
- Latapy, M., C. Magnien, and N. Del Vecchio 2008 Basic Notions for the Analysis of Large Two-Mode Networks. *Social Networks* 30:31-48.
- Lekson, S. H. 1996 Scale and Process in the Southwest. *In* *Interpreting Southwestern Diversity: Underlying Principles and Overarching Patterns*. P. R. Fish and J. J. Reid, eds. Pp. 81-86. Tempe: Department of Anthropology.
- Leskovec, J., J. Kleinberg, and C. Faloutsos 2007 Graph Evolution: Densification and Shrinking Diameters. *Transactions on Knowledge and Discovery from Data* 1:1-41.
- Lévi-Strauss, C. 1953 Social Structure. *In* *Anthropology Today*. A. L. Kroeber, ed. Pp. 524-533. Chicago: University of Chicago Press.
- Lévi-Strauss, C. 1967 *Structural Anthropology*. Garden City: Anchor.
- Linnington, R. E., F. Delpino, and M. Pallottino 1978 *Alle origini di Tarquinia: Scoperta di un*

- abitato villanoviano sui Monterozzi. *Studi Etruschi* 46:3-23.
- Lugli, F., and C. Rosa 2001 Prime evidenze di opere di terrazzamento del Capitolium nell'età del Bronzo Recente. *Bullettino della Commissione Archeologica Comunale di Roma* 102:281-290.
- Lugli, F., S. Brincatt, and F. Micarelli 2001 Le tombe dell'età del Ferro e l'attività metallurgica dall'età del Ferro al periodo arcaico. *Bullettino della Commissione Archeologica Comunale di Roma* 102:307-320.
- Macaulay, R. 1988 The Rise and Fall of the Vernacular. *In On Language: Rhetorica, Phonologica, Syntactica—A Festschrift for Robert P. Stockwell*. C. Duncan-Rose and T. Venneman, eds. Pp. 106-115. London: Routledge.
- MacDonald, P. L., and R. C. Gardner 2000 Type I Error Rate Comparisons of Post Hoc Procedures for I×J Chi-Square Tables. *Educational and Psychological Measurement* 60:735-754.
- Maffei, A., and F. Nastasi, eds. 1990 *Caere e il suo territorio da Agylla a Centumcellae*. Rome: Istituto Poligrafico e Zecca dello Stato.
- Malcus, B. 1984 Area D (Ovest). *In San Giovenale: Materiali e problemi*. S. Forsberg and B. E. Thomasson, eds. Pp. 37-47. Göteborg: P. Åström.
- Mallegni, F., and B. Lippi 2008 Considerazioni antropologiche sugli inumati nell'Area Sacra dell'abitato di Tarquinia. *In Sepolti tra i vivi/Buried Among the Living: Evidenza ed interpretazione di contesti funerari in abitato*. G. Bartoloni and M. G. Benedettini, eds. Pp. 795-804. Rome: Quasar.
- Mandolesi, A. 1999 *La 'prima' Tarquinia: L'insediamento protostorico sulla Civita e nel territorio circostante*. Florence: All'Insegna del Giglio.
- Mannheim, B. 1991 *The Language of the Inka Since the European Invasion*. Austin: University of Texas Press.
- Manning, S. W., and L. Hulin 2005 Maritime Commerce and Geographies of Mobility in the Late Bronze Age of the Eastern Mediterranean: Problematizations. *In The Archaeology of Mediterranean Prehistory*. E. Blake and A. B. Knapp, eds. Pp. 270-302. Oxford: Blackwell.
- Marchesini, S. 2008 *Prosopographia Etrusca, II, 1, Studia: Gentium Mobilitas*. Rome: L'Erma di Bretschneider.
- Marcus, J. 1992 Dynamic Cycles of Mesoamerican States. *National Geographic Research and Exploration* 8:392-411.
- Marcus, J. 1998 The Peaks and Valleys of Ancient States: An Extension of the Dynamic Model. *In Archaic States*. G. M. Feinman and J. Marcus, eds. Pp. 59-94. Santa Fe: School of American Research.
- Marcus, J., and J. Sabloff, eds. 2008 *The Ancient City: New Perspectives on Urbanism in the Old and New World*. Santa Fe: School for Advanced Research.
- McCarty, C., P. D. Killworth, H. R. Bernard, E. Johnsen, and G. Shelley 2000 Comparing Two Methods for Estimating Network Size. *Human Organization* 60:28-39.
- McGuire, R. H. 1996 Why Complexity is too Simple. *In Debating Complexity*. D. A. Meyer, P.

- C. Dawson, and D. T. Hanna, eds. Pp. 23-29. Calgary: Archaeological Association of the University of Calgary.
- McPherson, J. M. 2004 A Blau Space Primer: Prolegomenon to an Ecology of Affiliation. *Industrial and Corporate Change* 13:263-280.
- McPherson, J. M., and J. Ranger-Moore 1991 Evolution on a Dancing Landscape: Organizations and Networks in Dynamic Blau Space. *Social Forces* 70:19-42.
- Mishra, N., D. M. Romero, and P. Tsaparas 2013 Estimating the Relative Utility of Networks for Predicting User Activities. *In Proceedings of the 22nd ACM International Conference on Information and Knowledge Management (CIKM)*. Pp. 1047-1056.
- Mizoguchi, K. 2009 Nodes and Edges: A Network Approach to Hierarchisation and State Formation in Japan. *Journal of Anthropological Archaeology* 28:14-26.
- Mogetta, M., and J. Becker 2014 Archaeological Research at Gabii, Italy: The Gabii Project Excavations, 2009-2011. *American Journal of Archaeology* 118:171-188.
- Momigliano, A. 1963 An Interim Report on the Origins of Rome. *Journal of Roman Studies* 53:95-121.
- Mommsen 1888[1854] *The History of Rome*. W. P. Dickson, trans. New York: Charles Scribner's Sons.
- Montgomery, J. 2010 Passports from the Past: Investigating Human Dispersals Using Strontium Isotope Analysis of Tooth Enamel. *Annals of Human Biology* 37:325-346.
- Moreno, J. L. 1934. *Who Shall Survive? Foundations of Sociometry, Group Psychotherapy, and Sociodrama*. Washington, DC: Nervous and Mental Disease.
- Moreno, J. L., and H. H. Jennings 1938 Statistics of Social Configurations. *Sociometry* 1:342-374.
- Moretti, M. 1959 Tarquinia—La necropoli villanoviana “alle Rose”. *Notizie degli Scavi di Antichità* 13:112-139.
- Motta, L. 2002 Planting the Seed of Rome. *Vegetation History and Archaeobotany* 11:71-78.
- Motta, L. 2011 *The Seed of the Roman State: Archaeobotany in Early Rome*. Ph.D. dissertation, Department of Archaeology, University of Cambridge.
- Motta, L., and N. Terrenato 2006 The Origins of the State Par Excellence: Power and Society in Iron Age Rome. *In Celtes et Gaulois, l'Archéologie face à l'Histoire*, 4: Les mutations de la fin de l'âge du Fer. C. C. Haselgrove and V. Guichard, eds. Pp. 225-234. Glux-en-Glenne: Bibracte.
- Müller-Karpe H. 1959 *Vom Anfang Roms*. Heidelberg: F.H. Kerle.
- Müller-Karpe H. 1962 *Zur Stadtwerdung Roms*. Heidelberg: F.H. Kerle.
- Naroll, R. A. 1956 A Preliminary Index of Social Development. *American Anthropologist*: 687-715.
- Neal, Z. 2013 *The Connected City: How Networks are Shaping the Modern Metropolis*. New York: Routledge.

- Negrone Catacchio, N., and M. Cardosa 2005 Case, forni e magazzini: Un nuovo ‘quartiere’ di Sorgenti della Nova (Viterbo—Lazio). *In* *Communities and Settlements from the Neolithic to the Early Medieval Period*. P. Attema, A. Nijboer, and A. Zifferero, eds. Pp. 683-688. Oxford: Oxford University Press.
- Negrone Catacchio, N., and M. Cardosa 2007 *Sorgenti della Nova: Un abitato tra protostoria e Medioevo, guida allo scavo*. Milan: Laurum.
- Newman, M. E. J. 2001a The Structure of Scientific Collaboration Networks. *Proceedings of the National Academy of Sciences* 98:404-409.
- Newman, M. E. J. 2001b Scientific Collaboration Networks, II: Shortest Paths, Weighted Networks, and Centrality. *Physical Review E* 64:016132.
- Newman, M. E. J. 2003 The Structure and Function of Complex Networks. *Society for Industrial and Applied Mathematics Review* 45:167-256.
- Newman, M. E. J. 2010 *Networks: An Introduction*. New York: Oxford University Press.
- Newman, M. E. J. 2011 Communities, Modules and Large-Scale Structure in Networks. *Nature Physics* 8:25-31.
- Niebuhr, B. G. 1831[1812] *The History of Rome*. J. C. Hare and C. Thirlwall, trans. Cambridge: J. Smith for J. Taylor.
- Nijboer, A. J. 1998 From Household Production to Workshops: Archaeological Evidence for Economic Transformation, Pre-Monetary Exchange and Urbanisation in Central Italy from 800 to 400 B.C. Groningen: Groningen Institute of Archaeology.
- Nijboer, A. J. 2010 Italy, Its Interconnections and Cultural Shifts During the Iron Age. *Bollettino di Archeologia Online* 1(F/F2/1):1-22.
- Nijboer A. J., J. van der Plicht, A. M. Bietti Sestieri, and A. De Santis 2000. A High Chronology for the Early Iron Age in Central Italy. *Palaeohistoria* 41/42:163-176.
- O’Shea, J. M. 1984 *Mortuary Variability: An Archaeological Investigation*. New York: Academic Press.
- O’Shea, J. M. 1996 *Villagers of the Maros: A Portrait of an Early Bronze Age Society*. New York: Plenum Press.
- O’Shea, J. M., and A. W. Barker 1996 Measuring Social Complexity and Variation: A Categorical Imperative? *In* *Emergent Complexity: The Evolution of Intermediate Societies*. J. Arnold, ed. Pp. 13-24. Ann Arbor: International Monographs in Prehistory.
- Onnela, J.-P., J. Saramäki, J. Kertész, and K. Kaski 2005 Intensity and Coherence of Motifs in Weighted Complex Networks. *Physical Review E* 71:065103.
- Opsahl, T. 2013 Triadic Closure in Two-Mode Networks: Redefining the Global and Local Clustering Coefficients. *Social Networks* 35:159-167.
- Opsahl, T., and P. Panzarasa 2009 Clustering in Weighted Networks. *Social Networks* 31:155-163.
- Pacciarelli, M. 1991 Territorio, insediamento, comunità in Etruria meridionale agli esordi del processo di urbanizzazione. *Scienze dell’Antichità* 5:163-208.

- Pacciarelli, M. 1994 Sviluppi verso l'urbanizzazione nell'Italia tirrenica protostorica. *In* La presenza etrusca nella Campania meridionale. Pp. 227-253. Florence: Leo S. Olschki.
- Pacciarelli, M. 2001 Dal villaggio alla città: La svolta protourbana del 1000 a.C. nell'Italia tirrenica. Florence: All'Insegna del Giglio.
- Pacciarelli, M. 2009 Verso i centri protourbani: Situazioni a confronto da Etruria meridionale, Campania e Calabria. *Scienze dell'Antichità* 15:371-416.
- Pacciarelli, M. 2010 Forme di complessità sociale nelle comunità protourbane dell'Etruria meridionale. *In* L'Etrurie et l'Ombrie avant Rome: Cité et territoire. P. Fontaine, ed. Pp. 17-33. Bruxelles: Institut Historique Belge de Rome.
- Padrón, B., M. Nogales, and A. Traveset 2011 Alternative Approaches of Transforming Bimodal into Unimodal Mutualistic Networks: The Usefulness of Preserving Weighted Information. *Basic and Applied Ecology* 12:713-721.
- Parkinson, W. A., and M. L. Galaty 2007 Secondary States in Perspective: An Integrated Approach to State Formation in the Prehistoric Aegean. *American Anthropologist* 109:113-129.
- Parsons, T. 1951 *The Social System*. New York: Free Press.
- Passarello, P. 1973 Aspetti paleodemografici sull'età del ferro in Italia: I villanoviani di Veio. *Rivista di Antropologia* 58:149-156.
- Pauketat, T. R. 2007 *Chieftoms and Other Archaeological Delusions*. Plymouth: AltaMira Press.
- Peacock, J. L. 1986 *The Anthropological Lens: Harsh Light, Soft Focus*. New York: Cambridge University Press.
- Pearson, M. P. 1999 *The Archaeology of Death and Burial*. Stroud: Sutton.
- Peel, L., and A. Clauset 2015 Detecting Change Points in the Large-Scale Structure of Evolving Networks. *In* Proceedings of the 29th AAAI Conference on Artificial Intelligence. Pp. 2914-2920. Menlo Park: AAAI Press.
- Peroni, R. 1961 Allumiere: Scavo di tombe in località La Pozza. *Notizie degli Scavi* 14:341-362.
- Peroni, R. 1962 S. Omobono: Materiali dell'età del Bronzo e degli inizi dell'età del Ferro. *Bullettino della Commissione Archeologica Comunale di Roma* 77:7-32.
- Peroni, R. 1988 Comunità e insediamenti in Italia fra età del Bronzo e prima età del Ferro. *In* Storia di Roma. A. Momigliano and A. Schiavone, eds. Pp. 6-37. Turin: Einaudi.
- Peroni, R. 1994 *Introduzione alla protostoria italiana*. Bari: Laterza.
- Peroni, R. 1996 *L'Italia alle soglie della storia*. Rome: Laterza.
- Peroni, R. 1997 *Introduzione*. *In* Roma, la città prima della città: I tempi di una nascita—La cronologia delle sepolture ad inumazione di Roma e del Lazio nella prima età del ferro. M. Bettelli. Pp. 13-15. Rome: L'Erma di Bretschneider.
- Peroni, R., and F. di Gennaro 1986 Aspetti regionali dello sviluppo dell'insediamento protostorico nell'Italia centro-meridionale alla luce dei dati archeologici e ambientali. *Dialoghi di Archeologia* 2:193-200.

- Pescosolido, B. A. 2007 The Sociology of Social Networks. *In* 21st Century Sociology: A Reference Handbook. B. Bryant and D. Peck, eds. Pp. 208-217. Thousand Oaks: Sage.
- Pigorini, L. 1871 Bibliografia paleontologica italiana: Dal 1850 al 1871. Parma: Rossi-Ubaldi.
- Pigorini, L., and J. Lubbock 1869 Notes on the Hut-Urns and Other Objects Discovered in an Ancient Cemetery in the Commune of Marino (Province of Rome). *Archaeologia* 42:99-123.
- Pinza, G. 1897 La conservazione delle teste umane e le idee ed i costumi coi quali si connette. *Memorie della Società Geografica Italiana* 7:305-492.
- Pinza, G. 1898 Le civiltà primitive del Lazio. *Bullettino della Commissione Archeologica Comunale di Roma* 26:53-301.
- Pohl, I. 1972 The Iron Age Necropolis of Sorbo at Cerveteri. Stockholm: Svenska Institutet i Rom.
- Pollock, S. M. 1983 The Symbolism of Prestige: An Archaeological Example from the Royal Cemetery of Ur. Ph.D. Dissertation, Department of Anthropology, University of Michigan.
- Price, B. 1978 Secondary State Formation. *In* Origins of the State: The Anthropology of Political Evolution. R. Cohen and E. R. Service, eds. Pp. 161-186. Philadelphia: ISHI.
- Price, T. D., J. H. Burton, P. D. Fullagar, L. E. Wright, J. E. Buikstra, and V. Tiesler 2015 Strontium Isotopes and the Study of Human Mobility Among the Ancient Maya. *In* Archaeology and Bioarchaeology of Population Movement among the Prehispanic Maya. A. Cucina, ed. Pp. 119-132. New York: Springer.
- Radcliffe-Brown, A. R. 1940 On Social Structure. *Journal of the Royal Anthropological Institute of Great Britain and Ireland* 70:1-12.
- Radcliffe-Brown, A. R. 1957 A Natural Science of Society. Glencoe: Free Press.
- Raddatz, K. 1975 Bisenzio I, Beobachtungen auf einem eisenzeitlich-frühetruskischen Siedlungskomplex. *Hamburger Beiträge zur Archäologie* 5:1-60.
- Rajala, U. 2006 Expanding Centers, Increasing Complexity: Population Calculations and Urbanisation in Late Prehistoric Central Italy. *In* Studi di protostoria in onore di Renato Peroni. Pp. 508-512. Florence: All'Insegna del Giglio.
- Read, D. J., and M. C. Dean 2006 Variation in Modern Human Enamel Formation Times. *Journal of Human Evolution* 50:329-346.
- Redfield, R. 1960 The Little Community and Peasant Society and Culture. Chicago: University of Chicago Press.
- Redhouse, D. I., and S. Stoddart 2011 Mapping Etruscan State Formation. *In* State Formation in Italy and Greece: Questioning the Neoevolutionist Paradigm. N. Terrenato and D. Haggis, eds. Pp. 162-178. Oxford: Oxbow Books.
- Redner, S. 1998 How Popular is Your Paper? An Empirical Study of the Citation Distribution. *The European Physical Journal B* 4:131-134.
- Renfrew, A. 1975 Trade as Action at a Distance: Questions of Interaction and Communication. *In* Ancient Civilisations and Trade. J. A. Sabloff and C. C. Lamberg-Karlovsky, eds. Pp. 3-59. Albuquerque: School of American Research.

- Romano, E., G. Mecella, and P. Scandella 1979 Carta di classificazione dei terreni ai fini della programmazione della utilizzazione agricola e zootecnica del territorio. Rome: Regione Lazio (Assessorato Agricoltura e Foreste)/Istituto Sperimentale per la Nutrizione delle Piante.
- Routledge, B. 2013 *Archaeology and State Theory: Subjects and Objects of Power*. London: Bloomsbury Academic.
- Sabloff, P. L. W., and S. Cragg 2015 *Status and Role in Early States: A Comparative Analysis*. Santa Fe Institute Working Paper 2015-06-018.
- Saramäki, J., M. Kivelä, J.-P. Onnela, K. Kaski, and J. Kertész 2007 Generalizations of the Clustering Coefficient to Weighted Complex Networks. *Physical Review E* 75:027105.
- Saxe, A. 1970 *Social Dimensions of Mortuary Practices*. Ph.D. dissertation, Department of Anthropology, University of Michigan.
- Sayama, H., I. Pestov, J. Schmidt, B. J. Bush, C. Wong, J. Yamanoi, and T. Gross 2013 Modeling Complex Systems with Adaptive Networks. *Computers and Mathematics with Applications* 65:1645-1664.
- Scheffer, M., J. Bascompte, W.A. Brock, V. Brovkhin, S.R. Carpenter, V. Dakos, H. Held, E.H. van Nes, M. Rietkerk, and G. Sugihara 2009 Early-Warning Signals for Critical Transitions. *Nature* 461:53-59.
- Scheidel, W. 2013 Studying the State. *In The Oxford Handbook of the State in the Ancient Near East and Mediterranean*. P. F. Bang and W. Scheidel, eds. Pp. 5-58. New York: Oxford University Press.
- Schiappelli, A. 2012 Veii in the Protohistoric Period: A Topographical and Territorial Analysis. *In Veii: The Historical Topography of the Ancient City*. R. Cascino, H. Di Giuseppe, and H. L. Patterson, eds. Pp. 327-341. London: British School at Rome.
- Seglen, P. O. 1992 The Skewness of Science. *Journal of the American Society for Information Science* 43:628-638.
- Seifi, M., I. Junier, J.-B. Rouquier, S. Iskov, and J.-L. Guillaume 2013 Stable Community Cores in Complex Networks. *In Complex Networks*. R. Menezes, A. Evsukoff, and M. C. González, eds. Pp. 87-98. New York: Springer.
- Service, E. R. 1962 *Primitive Social Organization*. New York: Norton.
- Sewell, W. H., Jr. 2005 *The Logics of History: Social Theory and Social Transformation*. Chicago: University of Chicago Press.
- Sharpe, D. 2015 Your Chi-Square Test is Statistically Significant: Now What? *Practical Assessment, Research & Evaluation* 20:1-10.
- Shennan, S. J., and J. R. Wilkinson 2001 Ceramic Style Change and Neutral Evolution: A Case Study from Neolithic Europe. *American Antiquity* 66:577-593.
- Sherratt, A., and S. Sherratt 1993 The Growth of the Mediterranean Economy in the Early First Millennium BC. *World Archaeology* 24:361-378.
- Shryock, A., and D. L. Smail, eds. 2011 *Deep History: The Architecture of Past and Present*. Berkeley: University of California Press.

- Sindbæk, S. M. 2013 Broken Links and Black Boxes: Material Affiliations and Contextual Network Synthesis in the Viking World. *In* Network Analysis in Archaeology: New Approaches to Regional Interaction. C. Knappett, ed. Pp. 71-94. Oxford: Oxford University Press.
- Sinopoli, C. M. 1999 Levels of Complexity: Ceramic Variability at Vijayanagara. *In* Pottery and People: A Dynamic Interaction. J. Skibo and G. M. Feinman, eds. Pp. 115-136. Salt Lake City: University of Utah Press.
- Slovak, N. M., and A. Paytan 2011 Applications of Sr Isotopes in Archaeology. *In* Handbook of Environmental Isotope Geochemistry, Advances in Isotope Geochemistry. M. Baskaran, ed. Pp. 743-768. Berlin: Springer-Verlag.
- Smith, A. T. 2003 The Political Landscape: Constellations of Authority in Early Complex Polities. Berkeley: University of California Press.
- Smith, C. J. 1996 Early Rome and Latium: Economy and Society c. 1000-500 BC. New York: Oxford University Press.
- Spencer, C. S. 2003 War and Early State Formation in Oaxaca, Mexico. *Proceedings of the National Academy of Sciences* 100:11185-11187.
- Stein, G. 1987 Regional Economic Integration in Early State Societies: Third Millennium BC Pastoral Production at Gritille, Southeast Turkey. *Paléorient* 13:101-111.
- Steinmetz, G. 2007 The Relations between Sociology and History in the United States: The Current State of Affairs. *Journal of Historical Sociology* 20:1-12.
- Tagliacozzo, A. 1992 I mammiferi dei giacimenti pre- e protostorici italiani: Un inquadramento paleontologico e archeozoologico. *In* Italia Preistorica. A. Guidi and M. Piperno, eds. Pp. 68-97. Bari: Laterza.
- Tainter, J. 1975 The Archaeological Study of Social Change: Woodland Systems in West-Central Illinois. Ph.D. dissertation, Department of Anthropology, Northwestern University.
- Taylor, W. W. 1948 A Study of Archaeology. Menasha: American Anthropological Association.
- Terrenato, N. 2000 *Review of* Tarquinia: Testimonianze archeologiche e ricostruzione storica—Scavi sistematici nell’abitato (campagne 1982-1988). *American Journal of Archaeology* 104:404-405.
- Terrenato, N. 2002 The Innocents and the Sceptics: Antiquity and Classical Archaeology. *Antiquity* 76:1104-1111.
- Terrenato, N. 2005 “Start the Revolution without Me!” Recent Debates in Italian Classical Archaeology. *In* Communities and Settlements from the Neolithic to the Early Medieval Period. P. Attema, A. Nijboer, and A. Zifferero, eds. Pp. 39-43. Oxford: Oxford University Press.
- Terrenato, N., and D. Haggis 2011 Introduction. *In* State Formation in Italy and Greece: Questioning the Neoevolutionist Paradigm. N. Terrenato and D. Haggis, eds. Pp. 1-16. Oxford: Oxbow Books.
- Toms, J. 1986 The Relative Chronology of the Villanovan Cemetery of Quattro Fontanili at Veii. *AION* 8: 41-97.

- Toti, O. 1972 Nuovi elementi sulla fase protovillanoviana: L'abitato dell'Elceto. *Notiziario Museo Civico di Allumiere* 1:21-31.
- Toti, O. 1976 L'insediamento protostorico di Monte Rovello. *Notiziario Museo Civico Allumiere* 5:5-24.
- Trigger, B. G. 2003 *Understanding Early Civilizations: A Comparative Study*. New York: Cambridge University Press.
- Trucco, F. 2007 Indagini 1998-2004 nella necropoli tarquiniese di Villa Bruschi Falgari: Un primo bilancio. *In Archeologia in Etruria Meridionale*. M. Pandolfini Angeletti, ed. Pp. 183-198. Rome: L'Erma di Bretschneider.
- Trucco, F., G. Mieli, and R. Vargiu 2000 Lo scavo nella necropoli di Monte Tosto Alto. *In L'Etruria tra Italia, Europa e mondo mediterraneo*. N. Negroni Catacchio, ed. Pp. 483-494. Milan: Centro Studi di Preistoria e Archeologia.
- Trucco, F., D. De Angelis, C. Iaia, and R. Vargiu 2005 Nuovi dati sui rituali funerari della prima età del ferro a Tarquinia. *In Dinamiche di sviluppo delle città nell'Etruria meridionale: Veio, Caere, Tarquinia, Vulci*. Pp. 359-369. Rome: Istituti Editoriali e Poligrafici Internazionali.
- Tyner, J. A. 1974 *Persuasive Cartography*. Los Angeles: University of California Press.
- van der Plicht, J., H. J. Bruins, A. J. Nijboer 2009 The Iron Age around the Mediterranean: A High Chronology Perspective from the Groningen Radiocarbon Database. *Radiocarbon* 51:213-242.
- VanPool, C. S., and T. L. VanPool 1999 The Scientific Nature of Postprocessual Research. *American Antiquity* 64:33-53
- Vanzetti, A. 2008 Appunti per l'indagine sulle deposizioni umane in abitato durante la protostoria europea. *Scienze dell'Antichità* 14:745-769.
- Vighi, R. 1955 Il sepolcreto arcaico del Sorbo. *In Caere: Scavi di Ranieri Mengarelli*. Pp. 24-201. Rome: Accademia Nazionale dei Lincei.
- Wang, Q., and E. Fleury 2012 Fuzziness and Overlapping Communities in Large-Scale Networks. *Journal of Universal Computer Science* 18:457-486.
- Ward-Perkins, J. B. 1961 Veii: The Historical Topography of the Ancient City. *Papers of the British School at Rome* 29:1-123.
- Watson, J. B. 1970 Society as Organized Flow: The Tairora Case. *Southwestern Journal of Anthropology* 26:107-124.
- Watts, D. J. 2004 The "New" Science of Networks. *Annual Review of Sociology* 30:243-270.
- Watts, D. J., and S. Strogatz 1998 Collective Dynamics of 'Small-World' Networks. *Nature* 393:440-442.
- Watts, D. J., P. S. Dodds, and M. E. J. Newman 2002 Identity and Search in Social Networks. *Science* 296:1302-1305.
- Weinreich, U., W. Labov, and M. Herzog 1968 Empirical Foundations for a Theory of Language Change. *In Directions for Historical Linguistics*. W. Lehmann and Y. Malkiel, eds. Pp. 97-195. Austin: University of Texas Press.

- Wobst, H. M. 1978 The Archaeo-Ethnology of Hunter-Gatherers or the Tyranny of the Ethnographic Record in Archaeology. *American Antiquity* 43:303-309.
- Wolfe, A. W. 1978 The Rise of Network Thinking in Anthropology. *Social Networks* 1:53-64
- Wolfe, A. W. 2011 Anthropologist View of Social Network Analysis and Data Mining. *Social Network Analysis and Mining* 1:3-19.
- Wright, H. T. 1977 Recent Research on the Origin of the State. *Annual Review of Anthropology* 6:379-397.
- Wright, H. T. 2006 Early State Dynamics as Political Experiment. *Journal of Anthropological Research* 62:305-319.
- Yang, J., and J. Leskovec 2014 Overlapping Communities Explain Core-Periphery Organization of Networks. *Proceedings of the IEEE* 102:1892-1902.
- Yang, J., J. McAuley, J. Leskovec 2013 Community Detection in Networks with Node Attributes. *In IEEE International Conference on Data Mining (ICDM)*. Pp. 1151-1156. Washington: CPS.
- Yoffee, N. 1993 The Complications of Complexity in the Prehistoric Southwest. *In Understanding Complexity in the Prehistoric Southwest*. G. Gumerman and M. Gell-Mann, eds. Pp. 1-17. Reading, MA: Addison-Wesley Publishing Company.
- Yoffee, N. 2004 *Myths of the Archaic State: Evolution of the Earliest Cities, States, and Civilizations*. Cambridge: Cambridge University Press.
- Yoffee, N., and N. Terrenato 2015 Introduction: A History of the Study of Early Cities. *In The Cambridge World History*. N. Yoffee, ed. Pp. 1-24. New York: Cambridge University Press.
- Zhang, P., and C. Moore 2014 Scalable Detection of Statistically Significant Communities and Hierarchies, Using Message Passing for Modularity. *Proceedings of the National Academy of Sciences* 111:18144-18149.