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Envisioning Rome's Prehistoric River Harbor: An Interim Report from the Forum Boarium

DOI 10.1515/etst-2016-0001

Abstract: Following a brief discussion of the literature and intellectual history of Rome's river port, this article presents preliminary results from a mechanized coring survey of the Forum Boarium valley. Conducted in 2015, this survey produced empirical evidence on prehistoric human activity Rome's floodplain and acquired substantial data on the paleolandscape of the region, including the shifting position of the Tiber River and the discovery of lacustrine deposits in the valley. Additionally, consideration is given to the advantages and limitations posed by the natural landscape during the origins of settlement and early urban development at Rome.

Keywords: Early Rome, Environmental Archaeology, Coring Survey, Landscape Reconstruction, Prehistoric Harbor

In Book VIII of *The Aeneid*, as the Trojans prepare for battle against the Latins, the god Tiberinus appears before Aeneas and urges the weary traveler to journey up the river where he will find an ally, King Evander.[1] Reinvigorated by the divine message, Aeneas traverses the calm waters of the Tiber and berths his ship at the foot of Evander's settlement on the Palatine Hill.[2] In this climactic moment from Vergil's epic, the Tiber brings the hero to the very place where his descendants will one day build their magnificent city.[3] Although Aeneas' journey is mythological, it is nonetheless rooted in historical fact. Long before all roads led to Rome,

1 *Aen.* 8.18–85.

2 *Aen.* 8.86–106. Specifically, Aeneas lands near the Ara Maxima of Hercules. Although there is meager archaeological evidence for this structure, the literary record indicates that from the Archaic period it was one of the most prominent structures in the Forum Boarium (Livy 1.7.10–11; Tac. *Ann.* 12.24; Platner and Ashby 1929, 253–54; Coarelli 1992, 61–77; Cornell 1995, 40; Torelli 2006; Wiseman 2008, 56–7).

3 Meyers 2009, 245–47.

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the Tiber River served as a vital thoroughfare between the Eternal City and the wider Mediterranean world. Much like the story of Aeneas, countless sailors would have navigated the Tiber and disembarked in the valley later known as the Forum Boarium.[4] This was the gateway to early Rome.

While Vergil poetically portrays the natural environment of the Tiber River valley before it was transformed by the hands of man,[5] it was surely as difficult for his Augustan audience as for the modern reader to mentally erase the existing urban setting and visualize an extinct landscape. Recent decades, however, have witnessed advancement in field methodologies and scholarship that have made it possible to peel back the dense habitation layers at Rome.[6] A steadily increasing body of archaeological material from the city's earliest levels, produced during both new investigations and reassessments of old excavations, and comparisons with contemporary settlements in central Italy have begun to shed light on the origins of settlement at the site of Rome. These efforts are bolstered by the growing involvement of earth scientists and by environmental sampling, which provide valuable ecological perspectives on the city's paleolandscape. The current project aims to build upon this existing scholarship by offering insights on the topography and environment of the Forum Boarium valley while also producing new data on the extent of human activity in the vicinity of Rome's first river harbor.

Scholars have long recognized that Rome is located in an especially strategic position.[7] In contrast to other prehistoric settlements in central Italy, which were typically centered on homogeneous volcanic plateaus,[8] at the site of Rome the energy of the Tiber River dramatically transformed the landscape, leaving a disconnected set of steep hills and deeply incised valleys. This stretch of the Tiber is navigable to its mouth, permitting convenient access not only to saline marshes

4 Topographically speaking, the region of interest here is the valley surrounded by the Capitoline, Palatine, and Aventine hills. In the historical period, this region is variously referred to as the Forum Boarium, Forum Holitorium, and/or Velabrum. Although admittedly an anachronistic term in discussions of the prehistoric era, for the purpose of clarity, I refer to this region simply as the Forum Boarium valley.

5 *Aen.* 8.86–106.

6 E.g., Ioppolo 1972; Coarelli 1974, 1988, 2011; Colini 1977; Quilici 1979, 1995; Quilici Gigli 1986; Ammerman 1990, 2013; Terrenato 1992; 2011; Cazzella 2001; Meyers 2003; Motta 2011; Alessandri 2013; Fulminante 2014; Hopkins 2016.

7 E.g., Bloch 1960, 63–7; Toynbee 1970, 11–14; Cornell 1995, 48; Grandazzi 1997, 74–91; Meyers 2003, chap. 2. This modern sentiment was shared by the Romans themselves, as they praised Romulus' wise choice for locating his city (Cic. *De re pub*. 2.10–11; Livy 5.54).

8 The position of these hilltop settlements is often interpreted as reflecting a need for defense in an era when raiding and looting was common. For further background, see Smith 1996, 34–7.

for the production of salt, but also to wider Mediterranean exchange networks.[9] Moreover, a bend in the course of the river and the existence of the Tiberine Island make this location one of the few fordable points in the lower river, a factor which significantly influenced the east-west movement of people prior to the construction of bridges.[10] As such, the site of Rome marks an important crossroad for trade and communication in prehistoric central Italy.

In general terms, these locational benefits are all related to the Tiber, and more specifically, to the opportunities afforded by a natural harbor on the east bank of the river, the very place where Vergil sets Aeneas' arrival at Evander's Pallanteum. While discussions of prehistoric Rome often emphasize activity on the hills, where there is evidence of persistent habitation from at least the late second millennium,[11] scholars tend to discount the lowlands as inhospitable or unsuitable for urban development due to the persistent flooding of the Tiber.[12] Although the hilltops did indeed provide a secure setting for the growth of permanent domestic space, it was the natural harbor in the Forum Boarium valley—perhaps more than the famous seven hills—that had a profound impact on the birth and growth of a city. It was this specific location in the Tiber River valley that facilitated invaluable access to resources, trade, communication, and the movement of people, all of which made it possible for prehistoric Italians to settle and thrive at the site of Rome.

Renewed investigations in the Forum Boarium have utilized subsurface survey to generate new topographical and environmental evidence on the early river harbor. In addition to documenting the entire anthropic sequence in the valley, this project has produced evidence for the shifting position of the Tiber River, the effects of floods and sedimentation, and the existence of lacustrine deposits. Although much scholarship on the Forum Boarium begins necessarily in the Archaic period when archaeological and historical evidence becomes more prolific, discoveries made during this coring survey have extended the timeline of human activity in the region into the prehistoric era. The chronological focus here, to which I refer generically as "prehistory," is the long period leading to the boom in urban development and political upheavals of the sixth century B.C.E.

9 Salt was a vital commodity in the ancient period, as it was used for nutrition and preservation of meat. Coarelli 1988; 1992, 109–13; Smith 1996, 179–83; Filippi 2005, 98–9.

10 Platner and Ashby 1929, 224–25; Colini 1980, 43–5; Torelli 1990, 30; Meyers 2003, chap. 5.

11 Coarelli 1992, 112; Carandini 1997, 126–27; Cazzella 2001; Filippi 2005, 98–100; Cazzella et al. 2007; Alessandri 2013, 15; Fulminante 2014, 69–72.

12 Heiken et al. 2005, 59–84; Aldrete 2007, 10–50; Hopkins 2014, 30; 2016, 39–65. See also Ammerman 1990 for discussion of the massive reclamation project undertaken in the Forum Romanum valley in the Archaic period.

The late second and early first millennium B.C.E., also referred to as the Late Bronze and Early Iron Ages, correspond to the beginnings of sedentary habitation and profound socio-political transformations at the site of Rome.[13] It is becoming increasingly apparent that in order to support a permanent settlement and capitalize on the benefits provided by their local river harbor, the early inhabitants of Rome were forced to adapt to a volatile landscape and a destructive Tiber River.

Searching for Rome's Early River Harbor

Unfortunately, archaeological exploration in this region is impeded by the sheer depth of stratigraphy as well as the heavy impact of unbroken human occupation and urban development over three millennia. As a result, prehistoric levels in the Forum Boarium—and indeed throughout much of Rome—have been either obliterated or obscured, lying at a depth more than 10 m beneath the modern street level. It is this problem of accessibility that persistently complicates and restricts investigation of the city's earliest levels.

As the literary record dates to a period when Rome had far outgrown her humble river emporium, there is meager historical evidence for the harbor activity that once occupied the stretch of land at the foot of the Capitoline and Palatine hills.[14] By the late Republic, when the written record becomes more prevalent, commercial shipping was directed largely to Puteoli in the Bay of Naples, and later to Ostia.[15] Writing in the first century B.C.E., the antiquarian Varro mentions the existence of a *portus* in the vicinity of the Temple of Portunus.[16] Beginning in the 1930s, investigations in the area substantiated the existence of harbor infrastructure. Structures revealed on the bank of the Tiber in the Forum Boarium have

13 The labels of pre-urban, proto-urban, and urban are muddled, as is the chronological framework for prehistoric Rome. For background discussion, see Colonna 1974; Meyer 1983, esp. 91–5; Smith 1996; esp. 21–3, 34–7; Bettelli 1997; Fulminante 2014, 66–104. Suffice it to say that the periods of interest here are the origins of settlement at Rome and the gradual development of urban systems leading to the Archaic period.

14 More common are references to a military dockyard (*navalia*) in the Campus Martius. Livy 3.26.7–8; 45.42.12; Platner and Ashby 1929, 358–60; Coarelli 2000. See also Tucci and Cozza 2006 for discussion of *navalia* in the Testaccio region.

15 D'Arms 1974; Rickman 1988.

16 Varro *Ling*. 6.19; Colini 1980, 44–6. The Temple of Portunus can still be seen today in the Forum Boarium in its first century B.C.E. appearance (Platner and Ashby 1929, 430–31; Colini and Buzzetti 1986a; Buzzetti 1999a). Excavations in the podium indicate that the first phase of the structure dates to the late fourth or early third century B.C.E. (Ruggiero 1991–92, 265; Adam 1994, 49).

been interpreted as warehouses and shops, which date only to the second century B.C.E.[17] Excavations at the Sant'Omobono sanctuary, however, have afforded access to pre-Republican levels, including a sixth-century temple that once overlooked the archaic harbor.[18] The discovery of Bronze Age pottery (not in situ) during early excavations at Sant'Omobono reinforced scholarly theories that foreign merchants had frequented the area since the second millennium.[19]

Although there is general scholarly consensus on the location of the city's first river harbor,[20] reconstructions of the natural landscape and early urban development in the region remain largely conjectural. For example, Filippo Coarelli argues that the Portus Tiberinus existed in the area north of the Temple of Portunus and south of San Nicola in Carcere. He also credits Servius Tullius with the construction of the harbor, as well as the sanctuaries of Fortuna, Mater Matuta, and Portunus in the sixth century.[21] In a series of sketches from 1989 published in *Il Viver Quotidiano in Roma Antica*, Giovanni Ioppolo positions the archaic temple at Sant'Omobono directly on the bank of a bend in the river (fig. 1).[22] Lorenzo Quilici, however, provides the most fanciful reconstruction of the harbor (fig. 2). Built in 1994, his plastic model of archaic Rome was once on display at the Museo della Civiltà Romana and included an artificial and regularized harbor with ample docking space for boats set back from the river.[23]

Visualizations of the natural landscape have relied in part on historical references to Rome's valleys as swamps or with standing water.[24] In his etymological explanation for the name of the Aventine, Varro suggests that the word comes from *advehere*, because the hill was once cut off from the rest of the city by swamps, and people were ferried by rafts (*advehebantur ratibus*).[25] Plutarch provides a similar anecdote about ferries in the Velabrum, but suggests this was a circumstance only while the river was in flood.[26] Extrapolating from this problematic and scant

17 Colini and Buzzetti 1986b; Coarelli 2007, 315–16.
18 Colini 1940; 1977; Colonna 1959–60; 1991; Gjerstad 1962; Ioppolo 1972; Mura Sommella 1977; Coarelli 1981; 1992, 205–44. See also Brocato and Terrenato forthcoming for the most recent assessment of the temple's phases.
19 Peroni 1962; Colini 1980, 44; Coarelli 1988, 135–43; Pisani Sartorio in *Il Viver Quotidiano* 1989, 16–17; cf. Colonna 1959–1960.
20 Platner and Ashby 1929, 430–31; Cressedi 1949–51, 53; Colini and Buzzetti 1986b, 157; Richardson 1996, 320; Buzzetti 1999b.
21 Coarelli 1981; 1988; 1992, 215–21; 2007, 307–8.
22 *Il Viver Quotidiano in Roma Arcaica* 1989, fig. 3, tav. 1.
23 On the plastic model, see Quilici 1995; D'Amato 1997.
24 Ovid, *Fasti* 6.395–417; Prop. 4.9.5.
25 Varro *Ling*. 5.43–44.
26 Plut. *Rom*. 5.5; *cf*. Aldrete 2007, 168–69.

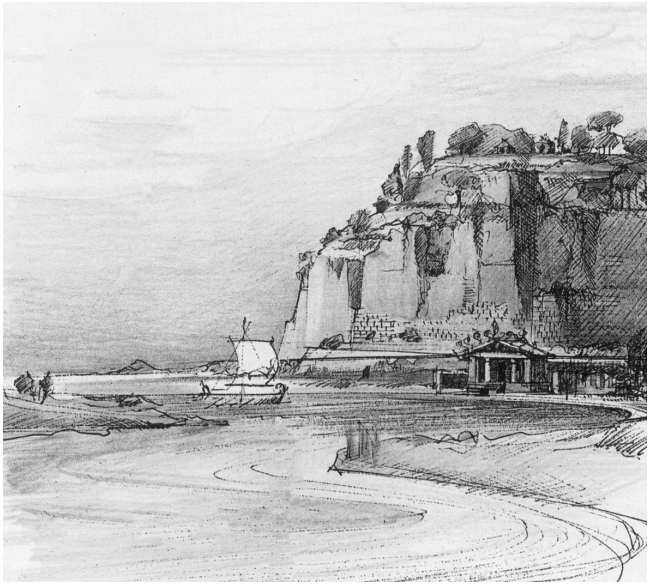

Fig. 1: Hypothetical reconstruction of the Forum Boarium valley and Capitoline Hill in the Archaic period after Giovanni Ioppolo, 1989 (author).

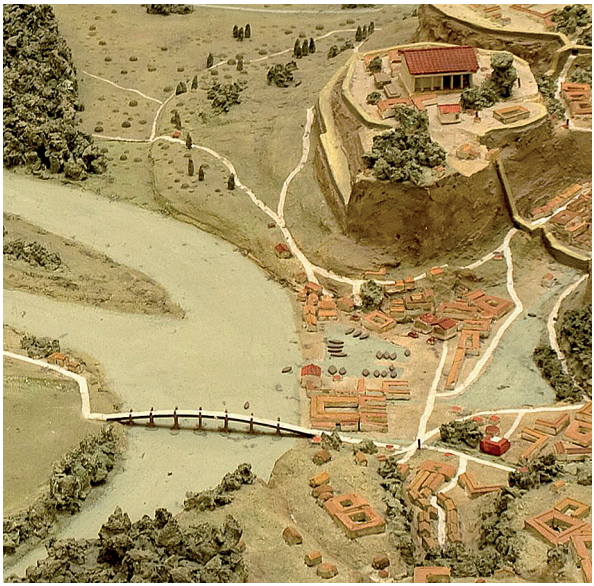

Fig. 2: Detail of Lorenzo Quilici's plastic model of sixth-century Rome, showing the river harbor in the Forum Boarium. Made in 1994, this reconstruction was once on display at the Museo della Civiltà Romana (author).

literary evidence, generations of scholars propagated a vision of permanently wet regions in early Rome.[27] Early examples can be found in the 1820 map by Giovanni Battista Brocchi and another in 1897 by Rodolfo Lanciani; both include a swampy area in the Forum Boarium that extends from the riverbank into the valley between the Capitoline and Palatine (traditionally referred to as the Velabrum) as well as between the Palatine and Aventine hills (the Circus Maximus valley).[28]

Given the lack of geoarchaeological data from the nascent city, in the 1990s the Comune di Roma commissioned a pilot study in the Velabrum that involved the novel use of a coring survey to access deeply buried layers across a wide surface area.[29] In his analysis of these boreholes, Albert Ammerman challenged conventional theories on the topography and environment of early Rome.[30] In particular, he determined that the prehistoric position of the Tiber River was approximately 100 m east of its modern course.[31] Ammerman also rejected the established notion of a swamp in the Velabrum valley, and instead argued that the region was seasonally wet and dry during the first millennium B.C.E.[32] The latter conclusion is in keeping with the dynamic nature of Mediterranean river valleys before human intervention; a floodplain, such as the one that existed in the prehistoric Forum Boarium valley, would have experienced seasonal variation, including periodic inundation and a subsequent drying process after flood waters receded.[33]

Although this initial set of cores in the Velabrum was hampered by recovery problems and never comprehensively published,[34] the project successfully established coring survey as an effective method of investigating deeply buried archaeological and geological stratigraphy. Moreover, Ammerman demonstrated that an investigation of paleoenvironmental conditions could produce new, substantive conclusions on early Rome. It was with this sense of optimism that the current project embarked on an intensive coring survey of the Forum Boarium in 2015, in

27 Platner and Ashby 1929, 549–50; Colini 1980, 44; Cressedi 1984, 250; Richardson 1992, 406–7.
28 Brocchi 1820, "La carta fisica del suolo di Roma"; Lanciani 1897, fig. 1; Ammerman 2006, 305–7, figs. 7–8.
29 Ammerman 1998, 215; 2006, 305–6.
30 Ammerman 1998; Ammerman et al. 2000; 2008.
31 Ammerman 2006, 307; 2013, 170–72.
32 Ammerman 1998, 291; Aldrete 2007, 168; Ammerman et al. 2008, 26.
33 For further background and references on the dynamics of Mediterranean river valleys, see Vita-Finzi 1969, 72–6; Macklin et al. 1995; Brown 1997, 237–47.
34 For discussion of recovery problems related to coring at great depth and below the water table, see Ammerman 1998, 217, n. 8 and n. 13; 2006, 300. For preliminary results, which unfortunately do not include comprehensive descriptions of these boreholes or detailed sedimentary analysis, see Ammerman 1998; Ammerman and Filippi 1998; 2004; Ammerman et al. 2000; 2008.

an effort to collect new topographical and environmental data on the region during the second and first millennia B.C.E.

Mechanized Coring Survey of the Forum Boarium

After more than a year of preparation and fundraising, our team produced 12 boreholes across the Forum Boarium valley in June of 2015. In order to make this project successful, more than 20 individuals were recruited to consult or participate in various aspects of the coring survey. In particular, we sought out experienced geological contractors,[35] who own and operate a Beretta drilling rig capable of producing boreholes to a depth of more than 50 m (fig. 3). These machines, which can drill through concrete and hard stone, produce boreholes with a diameter of 8 cm. In an effort to expose the lowest levels of anthropic activity and sample the natural geology of the valley, each of the 12 cores in the Forum Boarium was drilled to a minimum depth of 15 m (fig. 4). Given the challenges encountered in prior coring surveys, namely problems associated with drilling below the water table and the recovery of soft sediments, we approached the task cautiously. The extraction of the drilling bit from the hole was an especially precarious process. The machine operator needed to sense the composition of the sediment through which he was drilling and react accordingly, so that he did not lift the drill bit until the sediment was secured.[36] Thanks to the skilled drilling team, we were fortunate to achieve nearly 100% recovery in every borehole.

In addition to the field crew, a group of American and European scientists with diverse expertise (paleobotanists, geologists, and geomorphologists, among others) were invited to participate in the analytical phase of the project and to employ a large set of modern techniques in geoarchaeology and paleoenvironmental studies. These collaborative relationships proved invaluable and mutually beneficial.[37] After three weeks of drilling on and through the busy streets of Rome, this project produced nearly 200 m of stratigraphic data from the extensive

35 CNG S.r.l, a company based in Rome and led by Dott. Geol. Marcello Martinelli.

36 As we hoped to collect a great deal of soft, alluvial sediments, our geological contractors devised an effective strategy to plug the open end of the drill bit. The operator would drill through loose, soft sediment until he reached a level of stone or compact sediment, which would serve to plug the open end of the drill bit. When no stone or compact sediment was encountered, the operator could rapidly spin the drill bit to heat and harden the soft sediment into a makeshift plug. By doing so, the bit could be extracted from the hole while still retaining the sediment.

37 For example, through a collaboration with the Istituto Nazionale di Geofisica e Vulcanologia in Rome, we were able to draw upon the expertise of local geologists, who also contributed funds in order to deepen some of our boreholes (the deepest reaching 50 m below the modern street

Fig. 3: A view of the Beretta drilling machinery during work on borehole FB 39 behind the Temple of Portunus (author).

level) for their own ancillary research objectives. In this way, we have sought to maximize the productivity of this coring survey beyond the confines of archaeological or historical research.

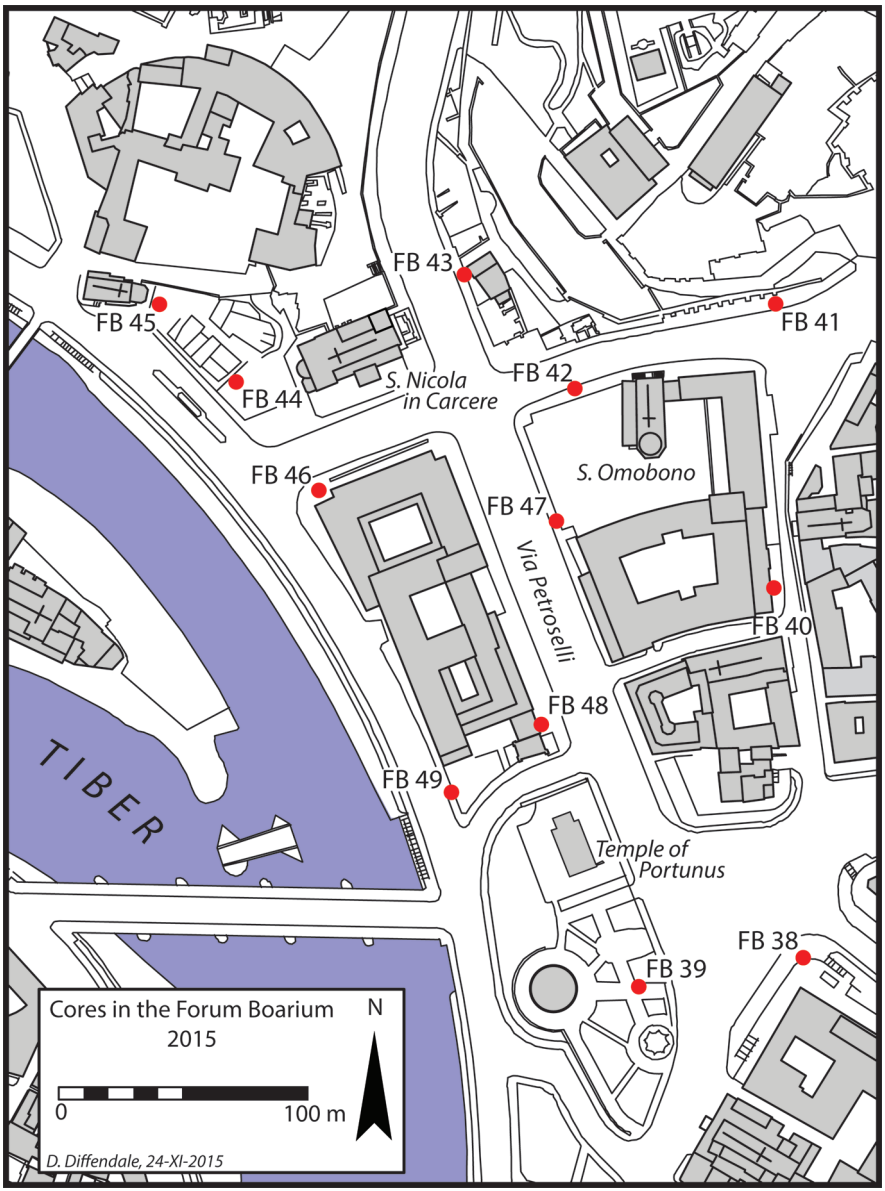

Fig. 4: Plan of the Forum Boarium, showing the locations of 12 cores made in 2015 (plan by Daniel Diffendale).

history of human activity in the Forum Boarium.[38] Each borehole contains a wealth of environmental data (e.g. soil horizons and stratigraphic profiles) as well as anthropic material (e.g. fragmentary artifacts and habitation surfaces). First, the author performed a stratigraphic examination of the boreholes, which included cleaning and making photographs, drawings, and detailed descriptions of sediment and artifacts. Subsequently, under the advisement of the scientific collaborators, the boreholes were sampled for a variety of secondary analyses, such as thin section, grain size, faunal remains, wet sieving for macrobotanical remains, pollen residue, paleomagnetism, and radiocarbon dating. With samples now disseminated and currently undergoing study at labs in Europe and the United States, final interpretations await pending analyses. Although many scientific results will be presented in detail in later reports, I would like to take this opportunity to introduce some new evidence for the prehistoric topography of the Forum Boarium.

Discussion of Preliminary Results

Hydrology

Our optimism for the potential of coring survey was justified almost immediately. In the first three boreholes produced (FB 38, 39, and 40; see fig. 4),[39] we found evidence of lacustrine deposits, that is, sediment formed in standing water with continuously water-saturated conditions. The discovery of deposits of this kind can be put in connection with data already in the literature. As discussed above, generations of scholars have envisioned Rome's lowland as swampy or even submerged during the city's archaic past.[40] In his study of the Velabrum cores, Albert Ammerman rejected this notion. Although he did in fact identify evidence of a *palude* or swamp, Ammerman describes this formation as an alder carr,[41] which he dates to the sixth millennium B.C.E. based on radio-

38 Each borehole was divided into 1 m sections and stored at the Sant'Omobono sanctuary in plastic tubes to await study.

39 The 12 boreholes from the 2015 coring survey of the Forum Boarium are labeled FB 38–49 and sequentially follow a set of percussion cores from the Sant'Omobono sanctuary produced in 2013 and 2014 (Brock and Terrenato forthcoming). This is also intended to prevent confusion with the Velabrum cores produced in 1996–2003, which were numbered 1–24 (Ammerman 2006, fig. 6).

40 See discussion above, as well as Ammerman 2006, 305–7.

41 A carr is a swampy formation sometimes found along rivers and lakes, documented in part by the existence of alder plant remains.

carbon samples. He goes on to argue convincingly that in the first millennium B.C.E. the valley experienced seasonal variation and was not permanently wet;[42] this data will be considered and compared with a pending sequence of radiocarbon dates and paleoecologial samples from the lacustrine deposits revealed in 2015.[43]

In one borehole the lacustrine sediment was covered by nearly 2 m of cappellaccio tuff. Quarried from the nearby hilltops, cappellaccio is a volcanic stone that was used extensively during the sixth century B.C.E., as evidenced by the Capitoline Temple, Regia, and Cloaca Maxima, among other structures in the nascent city. Although the precise purpose and spatial extent of the cappellaccio is unclear from its discovery in a single borehole, it is nonetheless apparent that the tuff exists in a secondary rather than natural deposit.[44] The cappellaccio, therefore, is tentatively interpreted as evidence of intentional filling of wet areas, paving, and/or embankment.

Another objective of this coring survey was to identify the prehistoric position and flooding activity of the Tiber River. As Albert Ammerman keenly recognized, virtually all representations of early Rome erroneously situate the Tiber in its modern position encased within massive retaining walls.[45] In reality, without anthropic imposition, Mediterranean riverine systems are highly active and mobile.[46] In the prehistoric era, the Tiber would have shifted freely within the river valley, changing its course and shaping the surrounding landscape in the process.[47] While coring in this river valley, a single borehole (that is, in a static position) can document the river's relative position as it moves over time. The river's proximity to a given location is judged based on sediment characteristics: coarse sediments exist in the riverbed, slightly finer loams and sands on the riverbank, and more clayey sediments in the floodplain. Although we currently await radiocarbon dates to provide an absolute chronology, it is evident that the

42 Ammerman 1998, 220; Ammerman et al. 2000, 13–15; Ammerman 2006, 307; Ammerman and Filippi 2004, 19–20.

43 Recent advancements in radiocarbon analysis surpass the state of the science in the 1990s. Research (e.g. Sevink et al. 2013) has shown that certain factors, such as problems associated with dating unidentified plant remains and the hard water effect, can potetntially bias radiocarbon results.

44 Cappellaccio tuff occurs naturally in pyroclastic deposits, which make up the internal structure of Rome's hills. For further background, see Ammerman and Terrenato 1996; Cifani 2001; 2008, 221–22.

45 Ammerman 2013, 171.

46 Vita-Finzi 1969; Brown and Ellis 1995; Brown 1997, 237–47.

47 Bozzano et al. 2000, 7.

Tiber once flowed further east than its modern position, perhaps extending into the Forum Boarium valley as far as the modern Via Luigi Petroselli.[48] In general terms, the deeper sections of these boreholes contain coarse alluvial deposits, remnants of when the Tiber flowed further east than its modern position. Moving forward in time and higher in elevation, the boreholes transition to the finer sediments of a floodplain. In this way, each of these boreholes documents both the shifting position of the Tiber as well as the immense amount of sedimentation in the valley.[49] Natural levee deposits dating to the historical period—dated by ceramics to the mid-Republic—were identified in FB 44, 45 and 46, as the Tiber neared its modern course.

In addition to the shifting position of the Tiber, floods also played a substantial role in transforming the landscape. Fed by the largest drainage basin in Italy, the Tiber River fluctuates throughout the course of a year, typically reaching its highest levels in the rainy winter months and its lowest levels during the dry summer.[50] Positioned immediately south of the confluence with the Anio River, Rome was built on one of the most flood-prone stretches of the Tiber. Indeed, inundations are a well-documented phenomenon in the city from the ancient through the modern period.[51] Although the magnitude of inundations would vary from season to season, it would not have been uncommon for the Forum Boarium valley to be submerged under meters of water for at least a period of several days in a given year.[52] These floods transported a considerable volume of sediment, which was deposited in the floodplain and on the natural levees of the river. Persistent inundations, likely as a result of both seasonal rainfall and sea level rise,[53] produced rapid sedimentation rates that caused the land surface to increase over time. Evidence from the Forum Boarium coring survey indicates that this sedimentation and, by extension, flooding was especially prevalent in the region during early centuries of human habitation at Rome.[54]

48 Cf. Ammerman 2006, 307.

49 See discussion on sedimentation in the following paragraph.

50 Aldrete 2007, 54–61.

51 Heiken et al. 2005, 59–84; Aldrete 2007, 10–50. The continuing issue of flooding in the modern city of Rome was so problematic that the Tiber was eventually canalized by massive embankment walls in the late 19th century. For discussion of flood sediments identified in the Velabrum cores, see Ammerman 1998, 219–20 as well as Ammerman and Filippi 2004, 16–23.

52 Aldrete 2007, 81–90.

53 For background on the documented rise in sea level and corresponding effects, see Bozzano et al. 2000; Marra et al. 2013.

54 The rate of sedimentation will be determined with radiocarbon dating, but initial estimates indicate rapid and substantial sedimentation in the valley during the second and first millennia

New evidence from the Forum Boarium, therefore, reveals how the Tiber River continuously transformed Rome's river valley. This mutability of the landscape problematizes modern efforts to capture a single moment in time through reconstructions of the "natural environment." As Rome's landscape existed in a state of flux both before and after the arrival of man, any static visualization belies the reality of an ever-changing landscape. This dynamism, as documented in the borehole record, sheds light on the type and degree of environmental stress endured by the early inhabitants of Rome. In particular, the shifting position of the Tiber, the effects of floods and sedimentation, as well as the formation and eventual reclamation of wet areas, were all important ecological factors that contributed to the scope and form of early human activity in the valley.

Anthropic Activity

In addition to environmental data, the coring survey also exposed evidence of prehistoric human activity scattered throughout the Forum Boarium valley. The existence of in situ anthropic deposits buried over a meter below archaic levels in the region was first discovered during the 2014 campaign at the Sant'Omobono sanctuary. Four radiocarbon samples on seeds from these deposits returned dates in the late second millennium B.C.E., confirming the presence of humans in the valley from the Late Bronze Age.[55] Beyond this ephemeral human occupation, the Forum Boarium coring survey, predictably, revealed no indication of cohesive or long-lasting prehistoric occupation in the valley: as an active floodplain surface, the region could feasibly permit only seasonal, dispersed, and temporary anthropic activity.[56] Currently, there is no evidence of expansive surface levels or large-scale constructions from the prehistoric era.[57] Instead, the boreholes show indications of anthropic deposits, many with ceramic fragments, scattered laterally and vertically throughout the floodplain. Although we await a full sequence of radio-

BCE. Cf. Ammerman et al. 2000, 13–15; Ammerman and Filippi 2004, 16–23 for discussion of sedimentation from the ninth through the sixth millennium B.C.E.

55 Brock and Terrenato forthcoming. These prehistoric deposits also include ceramic fragments, which are small and only vaguely diagnostic for the Bronze Age-Iron Age transition.

56 Cf. Purcell 1996, 268–69; Hopkins 2014, 36; 2016, 39–65.

57 That is, based on the borehole record, it is not possible to identify any contemporaneous occupation levels across the valley. Although such an argument could be revised by future discoveries, there is no stratigraphic indication of a sustained commercial district in the vicinity of the Forum Boarium prior to the Archaic period.

carbon dates, these disparate pockets of human activity in the floodplain range from at least the Late Bronze Age through the mid-Republican period.[58]

Given the documented frequency of inundations,[59] it is clear that any floodplain occupation would have been forced to contend with a dynamic environment. During calm periods when the river was at a low level, there was likely abundant human activity in the valley, both related to and independent from the harbor itself, which would have been temporarily abandoned or destroyed virtually every year with the rising level of the Tiber.[60] As such, Rome's prehistoric river harbor likely operated without a substantial investment in built infrastructure, which would have been jeopardized on a consistent basis.[61] Although floods certainly posed a threat to life and property, the early inhabitants of Rome were undoubtedly accustomed to the cyclical nature of the Tiber and modified their activities to permit a seasonal presence in the valley. Moreover, there is no reason to expect that inundations caused a significant loss of human life in the prehistoric era, as people could quickly evacuate the river valley and take refuge on the nearby hilltops. There remains, however, the possibility of secondary health issues associated with stagnant water in the valley, especially following a flood.[62]

Such pragmatic floodplain occupation could readily adapt to the environment and the practicalities of intermittent harbor activity. Lacking more advanced

58 While some of these anthropic deposits await ^{14}C dates, others were dated by ceramic fragments. See Brock and Terrenato forthcoming for late second millennium B.C.E. radiocarbon dates.

59 In the historical record (Aldrete 2007, 71–81) and in the cores, as shown by the rapid sedimentation rate.

60 Ammerman 1990, 636–38; Aldrete 2007, 39–50; Hopkins 2016.

61 Cf. Blackmann 1982, 90–4 for a discussion of prehistoric harbors, specifically the process of beaching ships and the need for little if any built infrastructure to operate effectively. Indeed, evidence from the Sant'Omobono sanctuary corroborates the limitations of built infrastructure in this region of Rome. The first known permanent construction in the floodplain is the archaic harbor temple, built in the early sixth century. The temple, which consisted of a mudbrick superstructure on a stone podium, had a relatively short life (Brocato and Terrenato forthcoming). At an elevation of 7 masl, this structure was extremely susceptible to floodwaters. Within a few generations, the archaic temple at Sant'Omobono was abandoned and replaced with a massive 5 m high platform, which supported the Republican twin temples. For background on the development and architectural significance of podia in Rome, see Potts 2011.

62 Transmitted by mosquitoes that breed in wet areas, malaria is one such hazard in flood-prone regions, although there is not yet empirical proof of the disease's existence in early Rome. Varro (*RR* 1.12.2) even offers a warning about *animalia quaedam minuta* that breed in marshy areas, suggesting at least a rudimentary awareness of health issues associated with stagnant water. For archeological evidence of malaria in ancient Italy, see Soren and Soren 1995; 1999; Sallares 2002, 105. For general background on the presence of malaria in ancient and modern Italy, see Jones 1907, 73; Sallares 2002, 66–8; 204; Snowden 2006, 7–52; Weiland 2011.

construction technologies,[63] the early inhabitants of Rome may have invested in stone embankment walls or temporary structures built of mudbrick and timber in the floodplain. If so, such readily available materials could have made it possible to rebuild quickly and cheaply following an inundation.[64] The available paleoenvironmental evidence, therefore, provides more support for the visualization provided by Ioppolo's sketches (fig. 1), as opposed to Quilici's plastic model (fig. 2). A permanent harbor equipped with regularized dockyards, as portrayed by Quilici, is not a realistic reconstruction of the region in the pre-Republican era.[65] Specialized harbor infrastructure on a large scale would have likely required the use of hydraulic concrete, a technology that was not available in Rome until the second century B.C.E.[66]

Even without substantial investment in built infrastructure, the prehistoric river harbor at Rome could have operated effectively. In his history of archaic Rome, Dionysius of Halicarnassus describes the practice of large ships docking at the mouth of the Tiber and unloading their wares onto smaller river boats.[67] Although Dionysius was writing in the first century B.C.E. and likely describing methods of boating in his own day,[68] this account remains illustrative: prehistoric shipping technology and river navigation would have operated similarly, albeit on a smaller scale.[69] Vessels capable of sailing the Tiber and stopping at the Forum Boarium valley would have been shallow bottomed and propelled by a combination of sail and oarsmen or towed along the bank.[70] It is, therefore, reasonable to hypothesize that, in the early centuries of human occupation at the site of Rome, shallow-bottomed boats were dragged onto the gently sloping, sandy shore at the foot of the Capitoline Hill. Such a scenario would permit merchants to berth their boats and unload wares in an era prior to the development of permanent harbor infrastructure.

63 See Cifani 2001 for discussion of building materials in early Rome.

64 Unexpected comparanda are found in the Malay-Indonesian archipelago during the 13th–15th centuries C.E. Research has shown that mercantile centers were situated at river mouths and exposed to seasonal flooding (Wink 2002, 428–29). These villages, which were built of bamboo and dried mud, were repeatedly destroyed and rebuilt in a matter of days.

65 Cf. Blackmann 1982, 90–4; Purcell 1996, 268–69.

66 Mogetta 2015.

67 Dionysius 3.44.

68 See Gabba 1991, 60–92 for discussion of Dionysius' methods and historical veracity.

69 Blackmann 1982, 90–4.

70 Casson 1965, 32; Colini 1980, 46. When the Tiber was at a high level, it is possible that even larger ships could have navigated its waters.

Conclusions and Future Research

The picture of early Rome continues to evolve. At this point, we await the results of laboratory analyses to provide additional paleoecological details. In particular, a large set of radiocarbon dates are required to situate the boreholes within a fixed chronological framework, which will permit a more precise reconstruction of the river's position in specific periods.[71] There are also plans for substantial paleobotanical and micromorphological analyses of samples from the boreholes. A future goal of this project is to incorporate all topographical and environmental data from the coring survey into a series of digital visualizations of the ancient landscape of the Forum Boarium valley at various points in the second and first millennia B.C.E.

Recent work in the Forum Boarium not only substantiates the extensive history of human activity in the valley, but also documents the precarious human-environment relationship that undoubtedly shaped the development of Rome's urban space. Any human activity in the floodplain would have encountered a number of logistical challenges related to the proximity of the Tiber River, including the effects of floodwaters and the consequent deposition of overbank sediment that regularly caused ground level inflation. The early inhabitants of Rome, however, would have readily adapted to this environmental stress and developed their settlement according to the opportunities and limitations posed by their natural landscape. Considerations of Rome's urban development and prehistoric habitation on the hills, therefore, must be supplemented with growing awareness of what must have been considerable activity in the floodplain below. More than just Aeneas' mythical landing site, the Forum Boarium valley would have been a prime destination for merchants and vital resources, both locally sourced and imported from across the Mediterranean. Despite the likelihood of short-term losses as a result of inundations, the long-term socio-economic advantages of occupying this strategic floodplain still made the site of Rome especially apt to sustain (proto)urban growth in the prehistoric era.[72] It was this exceptional site in the Tiber River valley that presented abundant opportunities for a fledgling settlement.

Acknowledgements: The Forum Boarium coring survey was promoted by the Sovrintendenza ai Beni Culturali di Roma Capitale. Funding for this project was

71 By utilizing accelerator mass spectrometry (AMS) radiocarbon analysis, we intend to provide more precise dates than were available to previous studies of the area.

72 Cf. Torrence and Grattan 1992, 12.

provided by the Etruscan Foundation, Fondazione Lemmermann, and the University of Michigan. In addition, I would like to express my gratitude to Nicola Terrenato and Jan Sevink for their wise guidance during the planning and execution of this project, as well as for their help in orchestrating various collaborative relationships. I would also like to thank Monica Ceci, Fabrizio Marra, Laura Motta, and Marcello Martinelli. Daniel Diffendale graciously provided his topographical expertise. This work would not have been possible without the assistance of Zachary Hallock and Susan Grouchy in the field. Lastly, I am grateful for the suggestions made by an anonymous reviewer.

Bibliography

Adam, J-P. 1994. *Le Temple de Portunus au Forum Boarium*. Rome: École Française de Rome.

Aldrete, G.S. 2007. *Floods of the Tiber in Ancient Rome*. Baltimore: Johns Hopkins University Press.

Alessandri, L. 2013. *Latium Vetus in the Bronze Age and Early Iron Age. BAR-IS* 2565. Oxford: Archaeopress.

Ammerman, A.J. 1990. "On the Origins of the Forum Romanum." *AJA* 94: 627–45.

Ammerman, A.J. 1998. "Environmental Archaeology in the Velabrum, Rome: Interim Report." *JRA* 11: 213–23.

Ammerman, A.J. 2006. "Adding Time to Rome's *Imago*." In *Imaging Ancient Rome*, edited by L. Haselberger and J. Humphrey, 297–308. *JRA* Supplementary Series 61. Portsmouth, R.I.: Journal of Roman Archaeology.

Ammerman, A.J. 2013. "Looking at Early Rome with Fresh Eyes: Transforming the Landscape." In *A Companion to the Archaeology of the Roman Republic*, edited by J. Evans, 169–80. Chichester, UK: Blackwell.

Ammerman, A.J., and D. Filippi. 1998. "Il Nuovo Tempio del Velabro." *BullCom* 99: 272–76.

Ammerman, A.J. 2004. "Dal Tevere all'Argileto." *BullCom* 105: 7–28.

Ammerman, A.J., and N. Terrenato. 1996. "Nuove osservazioni sul Colle Capitolino." *BullCom* 97: 35–46.

Ammerman, A.J., J. Miller, and S. Ramsay. 2000. "The Mid-Holocene Environment of the Velabrum in Rome." *Societa per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia* 8: 9–19.

Ammerman, A.J., I. Iliopoulos, F. Bondioli, D. Filippi, J. Hilditch, A. Manfredini, L. Pennisi, and N.A. Winter. 2008. "The Clay Beds in the Velabrum and the Earliest Tiles in Rome." *JRA* 21: 7–30.

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.

Blackmann, D.J. 1982. "Ancient Harbours in the Mediterranean, Part 1." *IJNA* 11: 79–104.

Bloch, R. 1960. *The Origins of Rome*. London: Praeger.

Bozzano, F., A. Andreucci, M. Gaeta, and R. Salucci. 2000. "A Geological Model of the Buried Tiber River Valley beneath the Historical Centre of Rome." *Bulletin of Engineering Geology and the Environment* 59: 1–21.

Brocato, P., and N. Terrenato. Forthcoming. "The Archaic Temple of S.Omobono: New Discoveries and Old Problems." In *The Age of Tarquinius Superbus*, edited by C. Smith and P. Lulof. Leuven: Peeters.

Brocchi, G.B. 1820. *Dello stato fisico del suolo di Roma: Memoria per servire d'illustrazione alla carta geognostica di questa città*. Rome: Nella Stamperia de Romanis.

Brock, A.L., and N. Terrenato. Forthcoming. "Rome in the Bronze Age: Late Second Millennium BC Radiocarbon Dates from the Forum Boarium." *Antiquity*.

Brown, A.G. 1997. *Alluvial Geoarchaeology: Floodplain Archaeology and Environmental Change*. Cambridge: Cambridge University Press.

Brown, A.G., and C. Ellis. 1995. "People, Climate and Alluviation: Theory, Research Design and New Sedimentological and Stratigraphic Data from Etruria." *PBSR* 63: 45–73.

Buzzetti, C. 1999a. "Portunus, Aedes." *LTUR* 4: 153–54.

Buzzetti, C. 1999b. "Portus Tiberinus." *LTUR* 4: 155–56.

Carandini, A. 1997. *La Nascita di Roma: dèi, lari, eroi e uomini all'alba di una civiltà*. Turin: G. Einaudi.

Casson, L. 1965. "Harbour and River Boats of Ancient Rome." *JRS* 55: 31–9.

Cazzella, A. 2001. "Sviluppi verso l'urbanizzazione a Roma alla luce dei recenti scavi nel Giardino Romano." *BullCom* 102: 265–68.

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 preistorica e protostorica*, 803–814. Atti della XL Riunione Scientifica IIPP (Roma, Sala dello Stenditoio del MBAC, 30 Novembre–3 Dicembre 2005). Florence: Istituto Italiano di Preistoria e Protostoria.

Cifani, G. 2001. "Le origini dell'architettura in pietra a Roma." In *From Huts to Houses: Transformations of Ancient Societies*, edited by R. Brandt, L. Karlsson, and N. Tomkinson, 55–61. Proceedings of an International Seminar Organized by the Norwegian and Swedish Institutes in Rome (21–24 September 1997). Stockholm: Svenska Institutet in Rom.

Cifani, G. 2008. *Architettura Romana Arcaica: Edilizia e Società tra Monarchia e Repubblica*. Rome: L'Erma di Bretschneider.

Colonna, G. 1959–60. "S. Omobono – la ceramic Etrusca dipinta." *BullCom* 77: 145–72.

Colonna, G. 1974. "Preistoria e protostoria di Roma e del Lazio." In *Popoli e Civiltà dell'Italia Antica*, edited by B. D'Agostino, P. E. Arias, and G. Colonna, 273–346. Rome: Multigrafica.

Colonna, G. 1991. "Le due fasi del tempio arcaico di S. Omobono." In *Stips Votiva: Papers Presented to C.M. Stibbe*, edited by M. Gnade, 51–9. Amsterdam: University of Amsterdam.

Colini, A.M. 1940. "L'area sacra di Sant'Omobono." *BullCom* 68: 75–6.

Colini, A.M. 1977. "Ambiente e storia dei tempi più antichi." *PP* 32: 9–19.

Colini, A.M. 1980. "Il porto fluviale del Foro Boario a Roma." In *The Seaborne Commerce of Ancient Rome: Studies in Archaeology and History*, edited by J. D'Arms and E. Kopff, 43–53. Rome: American Academy Memoirs.

Colini, A.M., and C. Buzzetti. 1986a. "Aedes Portuni in Portu Tiberino." *BullCom* 91: 7–30.

Colini, A.M. 1986b. "Portus Tiberinus." In *Il Tevere e le altre vie d'acqua del Lazio antico: settimo incontro di studio del comitato per l'archeologia laziale*, edited by S. Quilici Gigli, 157–97. Rome: Consiglio Nazionale delle Richerche.

Coarelli, F. 1974. *Guida Archeologica di Roma*. Verona: A. Mondadori.

Coarelli, F. 1981. "Sull'area sacra di S. Omobono." *PP* 36: 35–8.

Coarelli, F. 1988. "I santuari, il fiume, gli emporia." In *Storia di Roma: I, Roma in Italia*, edited by A. Momigliano and A. Schiavone, 127–51. Turin: Giulio Einaudi.

Coarelli, F. 1992. *Il Foro Boario: dalle origini alla fine della Repubblica*. 2nd ed. Rome: Quasar.
Coarelli, F. 2000. "Navalia." *LTUR* 3: 339–40.
Coarelli, F. 2007. *Rome and Environs: An Archaeological Guide*. Berkeley: University of California Press.
Coarelli, F. 2011. *Le origini di Roma: la cultura artistica dalle origini al III secolo a.C.* Milan: Jaca Book.
Cornell, T.J. 1995. *The Beginnings of Rome: Italy and Rome from the Bronze Age to the Public Wars (c. 1000–264 B.C.)*. London: Routledge.
Cressedi, G. 1949–51. "I Porti Fluviali in Roma Antica." *Atti della Pontificia Accademia Romana di Archeologia: Rendiconti* 24 (6):53–65
Cressedi, G. 1984. "Il Foro Boario e il Velabro." *BullCom* 89: 249–96.
D'Amato, C. 1997. "Il plastico di Roma arcaica nel Museo della Civiltà Romana." *Bollettino dei Musei Comunali di Roma* 11: 139–43.
D'Arms, J.H. 1974. "Puteoli in the Second Century of the Roman Empire: A Social and Economic Study," *JRS* 64: 104–24.
Filippi, D. 2005. "Il Velabro e le origini del Foro." *Workshop di Archeologia Classica* 2: 93–115.
Fulminante, F. 2014. *The Urbanisation of Rome and Latium Vetus: From the Bronze Age to the Archaic Era*. Cambridge: Cambridge University Press.
Gabba, E. 1991. *Dionysius and the History of Archaic Rome*. Berkeley: University of California Press.
Gjerstad, E. 1962. "Scavo stratigrafico a S. Omobono." *BullCom* 77: 33–108.
Grandazzi, A. 1997. *The Foundation of Rome: Myth and History*. Ithaca: Cornell University Press.
Heiken, G., R. Funiciello, and D. De Rita. 2005. *The Seven Hills of Rome: A Geological Tour of the Eternal City*. Princeton: Princeton University Press.
Hopkins, J.N. 2014. "The Creation of the Forum and the Making of Monumental Rome." In *Papers on Italian Urbanism in the First Millennium BC*, edited by E.C. Robinson, 29–61. *JRA* Supplementary Series 97. Portsmouth, R.I.: Journal of Roman Archaeology.
Hopkins, J.N. 2016. *The Genesis of Roman Architecture*. New Haven: Yale University Press. *Il Viver Quotidiano in Roma Arcaica: Materiali dagli scavi del Tempio Arcaico nell'area sacra di S. Omobono*. 1989. Rome: Procom.
Ioppolo, G. 1972. "I reperti ossei animali nell'area archeologica di S. Omobono (1962–1964)." *RendPontAcc* 44: 3–46.
Jones, W.H.S. 1907. *Malaria: A Neglected Factor in the History of Greece and Rome*. London: MacMillan and Co.
Lanciani, R. 1897. *The Ruins and Excavations of Ancient Rome*. New York: Blom.
Macklin, M.G., J. Lewin, and J.C. Woodward. 1995. "Quaternary Fluvial Systems in the Mediterranean Basin." In *Mediterranean Quaternary River Environments,* edited by J. Lewin, M. G. Macklin, and J.C. Woodward, 1–28. Rotterdam: A.A. Balkema.
Marra, F., F. Bozzano, and F.R. Cinti. 2013. "Chronostratigraphic and Lithologic Features of the Tiber River Sediments (Rome, Italy): Implications on the Post-Glacial Sea-Level Rise and Holocene Climate." *Global and Planetary Change* 107: 157–76.
Meyer, J.C. 1983. *Pre-Republican Rome: An Analysis of the Cultural and Chronological Relations, 1000–500 BC*. Odense: Odense University Press.
Meyers, G.E. 2003. "Etrusco-Italic Monumental Architectural Space from the Iron Age to the Archaic Period: An Examination of Approach and Access." Ph.D. diss., University of Texas at Austin.

Meyers, G.E. 2009. "The Divine River: Ancient Roman Identity and the Image of Tiberinus." *In The Nature and Function of Water, Baths, Bathing, and Hygiene from Antiquity through the Renaissance,* edited by C. Kosso and A. Scott, 233–48. Boston: Brill.
Mogetta, M. 2015. "A New Date for Concrete in Rome." *JRS* 105: 1–40.
Motta, L. 2011. "Seeds and the City: Archaeobotany and State Formation in Early Rome." In *State Formation in Italy and Greece: Questioning the Neoevolutionist Paradigm,* edited by N. Terrenato and D.C. Haggis, 245–55. Oxford: Oxbow Books.
Mura Sommella, A. 1977. "La decorazione architettonica del tempio arcaico." *PP* 32: 62–128.
Peroni, R. 1962. "S. Omobono: Materiali dell'età del bronzo e degli inizi dell'età del ferro." *BullCom* 77: 7–32.
Platner, S.B., and T. Ashby. 1929. *A Topographical Dictionary of Ancient Rome*. London: Oxford University Press.
Potts, C. 2011. "The Development and Architectural Significance of Early Etrusco-Italic Podia." *BABESCH* 86: 41–52.
Purcell, N. 1996. "The Ports of Rome: Evolution of a *façade maritime*." In *Roman Ostia Revisited: Archaeological and Historical Papers in Memory of Russell Meiggs*, edited by A. Zevi and A. Claridge, 267–79. London: British School at Rome.
Quilici, L. 1979. *Roma primitiva e le origini della civiltà laziale*. Rome: Newton Compton.
Quilici, L. 1995. "Il plastico di Roma arcaica al Museo della Civiltà Romana." *Ocnus* 3: 143–55.
Quilici Gigli, S. 1986. "Scali e raghetti sul Tevere in epoca arcaica." *Archeologia Laziale* 12: 71–89.
Richardson, L. 1992. *A New Topographical Dictionary of Ancient Rome*. Baltimore: Johns Hopkins University Press.
Rickman, G.E. 1988. "The Archaeology and History of Roman Ports." *IJNA* 17: 257–67.
Ruggiero, I. 1991–92. "Ricerche sul tempio di Portuno nel Foro Boario: per una rilettura del monumento." *BullCom* 94: 253–86.
Sallares, R. 2002. *Malaria and Rome: A History of Malaria in Ancient Italy*. Oxford: Oxford University Press.
Sevink, J., J. van der Plicht, H. Feiken, P.M. van Leusen, and C.C. Bakels. 2013. "The Holocene of the Agro Pontino Graben: Recent Advances in Its Palaeogeography, Palaeoecology, and Tephrostratigraphy." *Quaternary International* 303: 153–62.
Smith, C. 1996. *Early Rome and Latium: Economy and Society c. 1000 to 500 BC*. Oxford: Clarendon Press.
Snowden, F. 2006. *The Conquest of Malaria: Italy, 1900–1962*. New Haven: Yale University Press.
Soren, D., and N. Soren. 1995. "What Killed the Babies of Lugnano?" *Archaeology* 48: 43–8.
Soren, D., and N. Soren, eds. 1999. *A Roman Villa and a Late Roman Infant Cemetery: Excavation at Poggio Gramignano, Lugnano in Teverina*. Rome: Bibliotheca Archaeologica.
Terrenato, N. 1992. "Velia and Carinae: Some Observations on an Area of Archaic Rome." *New Developments in Italian Archaeology. Papers of the Fourth Conference of Italian Archaeology* 4: 31–47.
Terrenato, N. 2011. "The Versatile Clans: Archaic Rome and the Nature of Early City-States in Central Italy." In *State Formation in Italy and Greece: Questioning the Neoevolutionist Paradigm*, edited by N. Terrenato and D.C. Haggis, 231–44. Oxford: Oxbow Books.
Torelli, M. 1990. "Archaic Rome between Latium and Etruria." *CAH* 7.2: 30–51.
Torelli, M. 2006. "Ara Maxima Herculis: storia di un monumento." *MEFRA* 118: 573–620.
Torrence, R., and J. Grattan. 2002. "The Archaeology of Disasters: Past and Future Trends." In *Natural Disasters and Cultural Change,* edited by R. Torrence and J. Grattan, 1–18. London: Routledge.

Toynbee, A.J. 1970. “The Setting: Rome as Mistress of Italy.” In *Imperialism in the Roman Republic*, edited by E. Gruen, 10–17. New York: Holt, Rinehart and Winston.
Tucci, P.L., and L. Cozza. 2006. “Navalia.” *Archaeologia Classica* 57: 175–201.
Vita-Finzi, C. 1969. *The Mediterranean Valleys: Geological Changes in Historical Times*. London: Cambridge University Press.
Weiland, J. 2011. “Malaria in Etruria.” *Etruscan Studies* 14: 97–106.
Wink, A. 2002. “From the Mediterranean to the Indian Ocean: Medieval History in Geographic Perspective.” *Comparative Studies in Society and History* 44: 416–45.
Wiseman, T.P. 2008. *Unwritten Rome*. Exeter: University of Exeter Press.