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Natural Disaster, Climate Change, and Marginalized Social Agents in Pre-Roman Italy: Case Studies from Veneto and Puglia

Abstract: *The study of social marginality in pre-Roman Italy has only recently become a major area of study in archaeology. Similarly, discussions about crisis and collapse in the ancient Mediterranean have tended to focus on major centres of power and the élites, with relatively less attention given to how marginalized social segments were affected by accelerated, abrupt, or disruptive transformation. By focusing on the non-élites and their experience of socio-political and/or environmental instability, it has become apparent that our understanding of "crisis" in the ancient Mediterranean requires some rethinking. Here, we present two case studies on different historical and geographical contexts from first millennium BCE Italy: Veneto in the Iron Age, c. 650–575 BCE, and Daunia in the Hellenistic period, c. 350–200 BCE. We centre our analysis on social agents that were removed to different degrees from the main centres of political and economic power in these areas, or who might have achieved a change in their social status concomitantly with environmental shifts. Our case studies involve episodes of climatic and environmental stress, namely flooding in Veneto, and potential climatic oscillations affecting agriculturally marginal, drought-sensitive lands in Daunia. By building on evidence from these two different ecosystems and their social dynamics, we present questions about theoretical and methodological approaches to crisis, environmental shifts, and inequality in archaeology. Ultimately, we aim to contribute to a framework for the study of marginality and environmental challenges in different historical contexts.*

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1 Introduction

Research on late prehistoric and first millennium BCE Italy has long focused on élite social groups, their funerary rituals, material culture, and socio-cultural interactions.[1] More recently, however, research on marginalized and non-élite community segments has significantly increased, including by focusing on individuals such as infants and disabled people, who might not have achieved full social integration.[2] A research

1 Elisa Perego and Rafael Scopacasa, "Introduction: Burial and Social Change in First-Millennium BC Italy: An Agent-Focused Approach," in *Burial and Social Change in First-Millennium BC Italy: Approaching Social Agents. Gender, Personhood and Marginality*, ed. Elisa Perego and Rafael Scopacasa (Oxford: Oxbow Books, 2016): ix–xxxiv.

2 Elisa Perego, "Anomalous Mortuary Behaviour and Social Exclusion in Iron Age Italy: A Case Study From the Veneto Region," *Journal of Mediterranean Archaeology* 27, no. 2 (2014): 161–86; Elisa Perego, "Ideological Constructions of Childhood in Bronze and Early Iron Age Italy: Personhood Between Marginality and Social Inclusion," in *Children in Antiquity: Perspectives and Experiences of Childhood in the Ancient Mediterranean*, ed. Lesley A. Beaumont et al. (London: Routledge, 2020): 42–59; Elisa Perego and Rafael Scopacasa, *Burial and Social Change in First-Millennium BC Italy: Approaching Social Agents: Gender, Personhood and Marginality* (Oxford: Oxbow Books, 2016); Elisa Perego and Rafael Scopacasa, "Children and Marginality in Pre-Roman Samnium: A Personhood-Focused Approach," in *From Invisible to Visible: New Data and Methods for the Archaeology of Infant and Child Burials in Pre-Roman Italy*, ed. Jacopo Tabolli (Stockholm: Astrom Editions, 2018): 167–76; Elisa Perego and Rafael Scopacasa, "The Agency of the Displaced? Roman Expansion, Environmental Forces, and the Occupation of Marginal Landscapes in Ancient Italy," *Humanities* 7, no. 4 (2018): 116; Elisa Perego and Rafael Scopacasa, "Finale: Micro-Collapse and Marginality: Looking to the Future," in *Collapse or Survival? Crisis and Social Change in the Ancient Central Mediterranean*, ed. Elisa Perego et al. (Oxford: Oxbow Books, 2019): 155–70; Elisa Perego and Rafael Scopacasa, "Micro-Dynamics of Crisis Following Disaster Events in Late Bronze and Iron Age Northern Italy," in *Collapse or Survival: Micro-Dynamics of Crisis and Endurance in the Ancient Central Mediterranean*, ed. Elisa Perego et al. (Oxford: Oxbow Books, 2019): 1–28; Massimo Saracino et al., "Funerary Deviancy and Social Inequality in Protohistoric Italy: What the Dead Can Tell," *Preistoria Alpina* 49 (2017): 73–83; Francesca Fulminante, "Intersecting Age and Social Boundaries in Sub-Adult Burials of Central Italy During the First Millennium BC," in *From Invisible to Visible: New Data and Methods for the Archaeology of Infant and Child Burials in Pre-Roman Italy*, ed. Jacopo Tabolli (Stockholm: Astrom Editions, 2018): 29–40; Mariolina Gamba and Diego Voltolini, "L'inumazione presso i Veneti Antichi: Il caso della necropoli patavina di Palazzo Emo Capodilista-Tabacchi," *Arimnestos* 1 (2018): 209–26; Jacopo Tabolli, ed., *From Invisible to Visible: New Data and Methods for the Archaeology of Infant and Child Burials in Pre-Roman Italy* (Stockholm: Astrom Editions, 2018); Alba Pasini, "New Evidence of Prehistoric Neurosurgery in Italy: The Case of Castello Del Tartaro," *World Neurosurgery* 128 (2019): 556–61; Veronica Tamorri, "Taphonomic Approaches to Funerary Evidence in Times of Collapse and Crisis," in *Collapse or Survival? Crisis and Social Change in the Ancient Central Mediterranean*, ed. Elisa Perego et al. (Oxford: Oxbow Books, 2019): 29–56; Elisa Perego et al., "Marginal Identities in Iron Age Veneto: A Case Study Based on Micro-Scale Contextual Analysis and Burial Taphonomy," in *Multiple Identities in Prehistory, Early History and Presence*, ed. Alena Bistáková et al. (Nitra: Archeologický ústav SAV, 2020): 81–96; Elisa Perego et al., "Child Personhood in Iron Age Veneto: Insights from Micro-Scale Contextual Analysis and Burial Taphonomy," in *Ages and Abilities: The Stages of Childhood and Their Social Recognition in Prehistoric Europe and Beyond*, ed. Katharina Rebay-Salisbury and Doris Pany-Kucera (Oxford: Archaeopress, 2020): 174–92; Valeria Acconcia, "Superare il Guado: Rifles-

focus that deserves further attention is the complex interplay between social dynamics involving non-élite groups and environmental shifts or events, like climate change and natural disasters.

This chapter is an outcome of our long-term work on collapse, climate events, and marginality in the second and first millennia BCE central Mediterranean. We present two case studies that focus on different historical and geographical contexts from first millennium BCE Italy: Veneto in the Iron Age, c. 650–575 BCE, and Daunia – roughly the northern end of present-day Puglia – in the Hellenistic period, c. 350–200 BCE. We centre our analysis on social agents that were removed to different degrees from the main hubs of political and economic power in these areas, or those who might have achieved a change in their social status concomitantly with environmental shifts. Our case studies involve episodes of climatic and environmental stress, namely flooding in Veneto, and potential climatic oscillations affecting agriculturally marginal, drought-sensitive lands in Daunia.

Micro-scale analysis, which we employ in this study, allows for a high-resolution evaluation of the consequences of natural disasters and climate-related events. It also affords a re-evaluation of causative factors while exploring crises and their consequences on potentially vulnerable social segments – such as some women and infants, people with disabilities, and lower-status individuals – as these social segments might bear the brunt of crises to a greater extent than the dominant élite sectors. Here, we focus on two arid-prone plateaus in Daunia and flood-damaged burial areas in Veneto. By doing so, we can study how the affected individuals reacted to environmental challenges in contexts of growing social inequality. We address questions about different types of (bio)archaeological evidence and what they can convey about the agency of non-élite people in potentially transformative contexts. Ultimately, our analysis will contribute towards a framework for the archaeological study of the link between social and environmental stress, while addressing potential limitations in evidence and methods.

2 Background

Our research on collapse, climate, and marginality is a multiphase project exploring different levels of scale. We achieve this by moving between the macro- and the micro-scale, both in a temporal and a spatial sense.[3] We employ different analytical methods to examine the nature of collapse and crisis episodes in the late prehistoric

sioni su archeologia, storia sociale e modelli di autorappresentazione delle disparità: alcuni esempi dalle comunità antiche e moderne," *Ex Novo: Journal of Archaeology* 6 (2021): 125–57; Lorenzo Zamboni, "The Urbanization of Northern Italy: Contextualizing Early Settlement Nucleation in the Po Valley," *Journal of Archaeological Research* 29, no. 3 (2021): 387–430.

3 Perego and Scopacasa, "Finale: Micro-Collapse and Marginality."

and early Roman central Mediterranean,[4] as well as in smaller geographical areas in ancient and modern Italy.[5] To date, the sampled data mainly include information collated from available publications or datasets, comprising taphonomic, bioarchaeological, climate proxy, epigraphic, historical, and archaeological data. New isotope and osteological data on Veneto have been produced in the context of the CoPOWER project by Perego. Our most recent work focuses on the environmental and social impacts on health, including those related to infectious diseases and epidemics. These themes are increasingly at the forefront of many disciplines, such as medicine, anthropology, the medical humanities, and archaeology, particularly in view of the Covid pandemic, which is itself being addressed within the framework of disaster studies.[6]

The data collected and analysed so far have allowed us to individuate and explore diverse types of crisis episodes, according to factors such as the intensity, rate, and direction of change. They have also allowed us to investigate human responses to natural disasters, climate oscillation, and accelerated socio-political change. In our work, we study the effects of such phenomena on marginalized people, who are the key focus of our research. We explore, in particular, the consequences of crisis on the social agents that operated in the affected systems and fought to cope and survive. As regards natural disasters, like flooding, we examine how such events may have determined or influenced different trajectories of socio-political development, such as with the creation of different identities, including non-élite social statuses.[7] We are also interested in the different coping strategies that people adopted to survive and adapt to either abrupt or more prolonged environmental transformations.[8]

With particular regard to this chapter, we highlight the strengths and potential limitations of an integrated approach to inequality and environmental change in the distant past, with a focus on two very different ecosystems: riverine Veneto in north Italy and the more arid-prone Daunia in the south.

4 Elisa Perego et al., eds., *Collapse or Survival? Crisis and Social Change in the Ancient Central Mediterranean* (Oxford: Oxbow Books, 2019).

5 Perego and Scopacasa, "The Agency of the Displaced?"; Perego and Scopacasa, "Micro-Dynamics of Crisis"; Perego et al., "Marginal Identities in Iron Age Veneto"; Perego et al., "Child Personhood in Iron Age Veneto."

6 Robert Soden et al., "Accounting for Care in Times of Crisis," *Items: Social Science Research Council* (2022), https://items.ssrc.org [accessed 23.10.2023]. Elisa Perego carries out research within the pandemic-disaster framework.

7 Perego et al., "Marginal Identities in Iron Age Veneto"; Perego et al., "Child Personhood in Iron Age Veneto."

8 Perego and Scopacasa, "The Agency of the Displaced?"; Perego and Scopacasa, "Micro-Dynamics of Crisis."

3 Case study I: Iron Age Veneto

Our first case study explores the consequences of environmental instability as expressed through ritual practice. Our focus is on the settlements of Este and Padua in Iron Age Veneto, which were periodically affected by flooding episodes. These appear to have peaked in frequency and/or intensity around 650–575 BCE. These floods were not destructive enough to threaten survival and inhabitation, but they nevertheless affected the development of the sites involved and left proxies in the archaeological record. The floods of c. 650–575 BCE also coincided with a phase of innovation in ritual, technology, settlement organization, trade links, and consumption patterns, which seem to have been accompanied by an increase in social inequality and novel forms of hierarchy.[9]

Northeast Italy is prone to extreme hydrological events. In antiquity, water was already perceived as a dominant feature of the landscape, according, for example, to Roman sources.[10] In Veneto, both catastrophic floods and minor flooding episodes have been documented in prehistoric and historical times up until the present.[11] Another example is the recurrent flooding documented at the key Final Bronze Age site of Frattesina – a focus of the CoPOWER project – in connection to the paleoriver known as Po di Adria.[12]

Flooding has also been recorded at the Iron Age centres of Padua and Este.[13] A stratigraphic sequence obtained from the Ricovero cemetery at Este revealed a severe flooding episode that affected the site around the mid- or late seventh century BCE. This flooding episode was named flood FL 66b by the excavators of Ricovero in the 1980–1990s. This flood seems to coincide with significant changes in the cemetery, namely the construction of new pear-shaped burial mounds, which differed from previous mounds in shape, size, building techniques, and spatial arrangement (Fig. 1).

9 Elisa Perego, "Inequality, Abuse and Increased Socio-Political Complexity in Iron Age Veneto, c. 800–500 BC," in *Burial and Social Change in First-Millennium BC Italy: Approaching Social Agents: Gender, Personhood and Marginality*, ed. Elisa Perego and Rafael Scopacasa (Oxford: Oxbow Books, 2016): 273–309; Perego and Scopacasa, "Micro-Dynamics of Crisis."

10 Livy 10, 5; Pliny *NH* 3, 119–21, 126–31; Strabo 5, 1, 5; Vitruvius 1, 4, 11.

11 Nino Cenni, *La Verona di ieri* (Verona: Cassa di Risparmio di Verona, Vincenza e Belluno, 1973); Perego and Scopacasa, "Micro-Dynamics of Crisis", with bibliography.

12 Armando De Guio et al., "Tele-Frattesina: alla ricerca della firma spettrale della complessità," *Padusa* 45 (2009): 133–68.

13 Elodia Bianchin Citton et al., eds., *Presso l'Adige Ridente . . . recenti rinvenimenti archeologici da Este a Montagnana: Catalogo della mostra, Este, Museo Nazionale Atestino, 21 Febbraio 1998–21 Febbraio 1999* (Padua: Adle, 1998); Mariolina Gamba et al., eds., *La Prima Padova: Le Necropoli di Palazzo Capodilista-Tabacchi e di Via Tiepolo-Via S. Massimo tra il IX e l'VIII Secolo a.C.* (Basaldella di Campoformido, UD: La Tipografica, 2014).

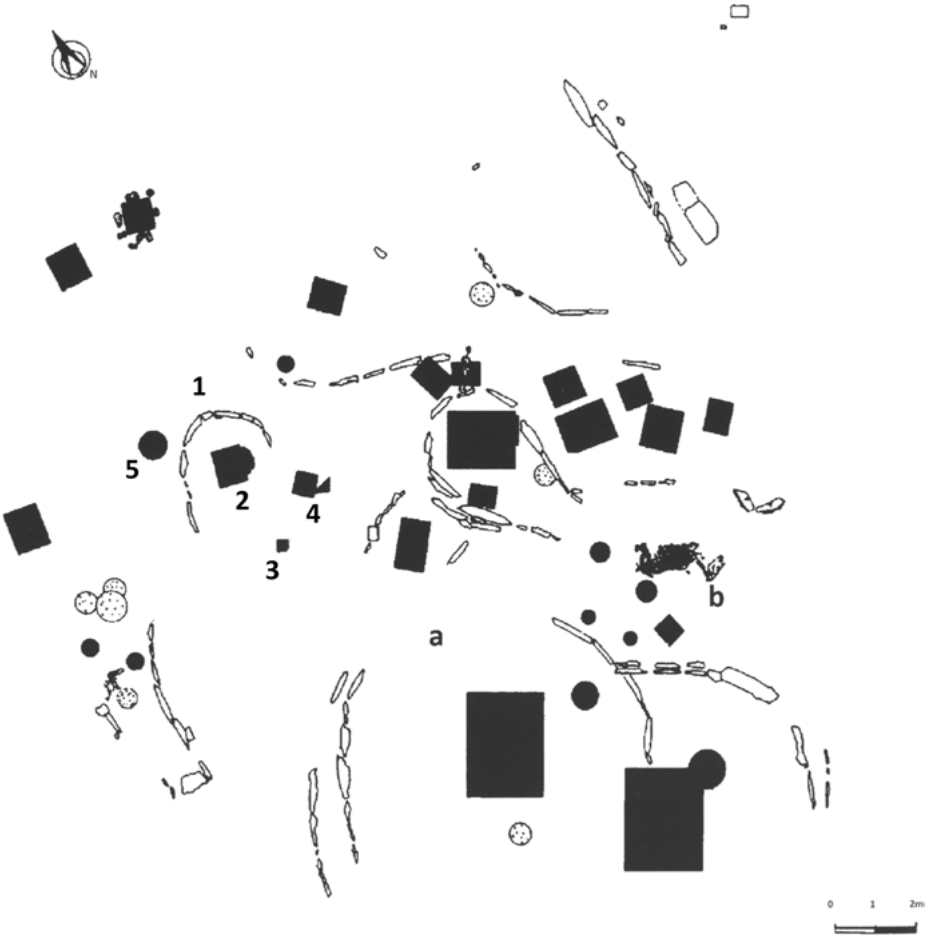

Fig. 1: Reconstruction of burial mounds from the Este Ricovero cemetery in Veneto (1: Tumulus L; 2: Tomb 19/1987; 3: Tomb 80; 4: Tomb 99; 5: Tomb 102).

One interesting case involves the construction of Tumulus L, a pear-shaped burial mound delimited by limestone slabs, which was built after flood FL 66b.[14] Tumulus L is one of the first tumuli of its kind to appear at the Este Ricovero cemetery. It contained a single central tomb of good standing that was made of stone slabs: a so-called *cassetta*, accessible through a central corridor – Tomb 19/1987.

Tomb 19/1987 contained two ceramic urns, which held the cremated remains of three individuals. According to the osteological analysis available, these include a thir-

14 Data analysis in Bianchin Citton et al., *Presso l'Adige Ridente* by Michelini and Bagolan, and in Perego and Scopacasa, "Micro-Dynamics of Crisis."

teen- to nineteen-year-old pair whose remains were placed together in the same vase. This practice – defined as "bone mingling" – is more often seen in wealthy tombs in Iron Age Veneto.[15] There was also a child in a second, more recent urn. The relatively rich personal adornments, and the tools found in the first and older urn, are usually associated with adult male and female individuals in this phase. Ceramic vessels were also found in the vicinity of the tomb or inside. These vessels might have been part of a dining and drinking set meant for the dead, or they might have been used by mourners during the rite.

Three additional cremation tombs, with less wealthy assemblages, were found on the edge of the tumulus, beyond the limestone boundary. These three graves have remained largely unpublished. However, preliminary evidence indicates that they were constructed after the first phase of use of the tomb inside Tumulus L.

- Tomb 99 was a smaller *cassetta* containing three urns, with the remains of an adult, a child, and a neonate; the latter was found with no surviving grave goods.
- Tomb 80 was a poorly built, small *cassetta*, with the remains of a neonate and no visible grave goods.
- Tomb 102 was a simple pit grave, with the remains of an adult estimated to be a woman.

Several elements suggest the lower social status of these deceased individuals in comparison to the ones buried inside Tumulus L. These include the more marginal location of the graves; the simpler tomb structures and grave goods; the burial of two neonates denied any discernible funerary provision; and possibly, the lack of bone-mingling occurrences. In addition, the individuals in Tombs 80 and 102 were buried alone: élite individuals often shared a grave with other individuals, presumably family members, in this phase in Este.[16]

What is especially significant is that Tumulus L was built over an earlier burial mound, predating flood FL 66b, which has been denominated Tumulus Tr. D by the excavators of the site. This was an altogether different structure – an earthen, collective burial mound containing at least three graves, one of which included multiple individuals. The boundary of Tumulus Tr. D was marked by trachyte stones instead of limestone, as in the later Tumulus L. An earlier *cassetta*, whose existence was demonstrated stratigraphically, was initially part of Tumulus Tr. D – "Tomb 143". Completely rebuilt after the flood, "Tomb 143" was to become the surviving central tomb in Tumulus L mentioned above, namely Tomb 19/1987. In view of stratigraphic and archaeological data, "Tomb 143" must have contained only one individual, probably the woman later placed in Tomb 19/1987, and some "feminine" grave goods, later left inside and around Tomb 19/1987. When flood FL 66b took place, around the mid- or late seventh

15 Perego, "Inequality, Abuse and Increased Socio-Political Complexity."

16 Perego, "Inequality, Abuse and Increased Socio-Political Complexity."

century BCE, Tumulus Tr. D was covered by silt and thin sand that had been drawn in by the waters. After the flood, a major restructuring of this burial area took place: Tumulus Tr. D was replaced by the pear-shaped and limestone-bound Tumulus L, "Tomb 143" was replaced by Tomb 19/1987, and the deceased from the earlier "Tomb 143" appears to have been re-buried in the new grave. Two new burials were also deposited in Tomb 19/1987, which became the central and only *cassetta* inside Tumulus L. Some stone slabs from the earlier "Tomb 143" were found near and under Tomb 19/1987, testifying to the existence and partial re-use of the earlier tomb container.[17]

Compared to the earlier Tumulus Tr. D, Tumulus L suggests a more hierarchical approach to the funerary space, which also possessed a temporal dimension; the tomb inside the mound, namely Tomb 19/1987, was also the most ancient, while the less wealthy tombs, which were not centrally positioned, were generally more recent according to the archaeological and stratigraphic data available. This seems to indicate a potential shift in the social organization of the community with respect to the earlier phase of Tumulus Tr. D. This shift is also reflected in multiple archaeological indicators, both from the Ricovero cemetery and from other Venetic sites like Padua. Our analysis underlines that at the micro-scale, change followed the first flood stratigraphically documented at Ricovero in this phase (FL 66b). Other innovations characterize the new pear-shaped tumuli in this excavated segment of Este Ricovero. These include the use of limestone slabs from the nearby Euganian hills and the appearance of a new pottery type, the so-called "red-and-black ware". Taken together, this evidence shows that flooding was intertwined with changes in pottery production, stone procurement, ritual practice, and even social hierarchies in the Este community. The burial group that initially used Tumulus Tr. D and might have built the later Tumulus L was part of this change.

How the floods contributed to these changes is a complex issue still under investigation. For one thing, instability in the hydrological regime may have affected the local economy and inhabitation, possibly contributing to social disruption and the redefinition of social relations. In Padua and in other Este cemeteries, this phase was also marked by the deposition of a number of abnormal inhumations, some of which included individuals buried prone and disarticulated or dismembered (Fig. 2). The preliminary osteological analysis of some of these individuals revealed pathologies and potential disabilities. Other individuals, like infants, could also receive differential burial treatments, such as inhumation instead of the much more common cremation rite, or deposition outside a burial mound or the formal cemetery – often with no visible grave goods. This evidence suggests that not all individuals enjoyed the same status and degree of social inclusion in death, and probably in life as well.[18]

17 For the detailed micro-stratigraphic analysis: Bianchin Citton et al., *Presso l'Adige Ridente*; Perego and Scopacasa, "Micro-Dynamics of Crisis."

18 Perego, "Anomalous Mortuary Behaviour and Social Exclusion"; Perego, "Inequality, Abuse and Increased Socio-Political Complexity"; Perego, "Ideological Constructions of Childhood"; Gamba and Vol-

These dynamics became more archaeologically evident from the seventh to the sixth century BCE, roughly at the same time or even in stratigraphic conjunction with flooding events. The deposition of one abnormal human inhumation and two horses, for example, was stratigraphically linked to flooding of Tumulus A in Padua c. 600 BCE. One of the two horses seems to have been killed via skull fracturing. Only after these external depositions did cremations begin to be deposited inside or on the border of Tumulus A.[19]

Fig. 2: Adult inhumation burial from the settlement of Oppeano La Montara, Verona area, Veneto.

In more recent periods, flooding in north Italy has been linked to episodes of famine, high disease burden, mass migration, and socio-political unrest. A case in point in the modern era is the nineteenth-century Boje movement in Veneto. Apparently precipitated by a catastrophic flood of the Adige in 1882 (reportedly caused by a convergence of climate and anthropic factors), this farmer movement was inscribed within a context of poverty and extensive disease in the area, where conditions, including those triggered by poor nutrition, like pellagra, were endemic.[20] The high incidence of physical trauma and disease in the context of famine, epidemics, and riverine instability in northern Italy has also been detected in cemetery populations from the seventeenth

tolini, "L'inumazione presso i Veneti"; Perego et al., "Marginal Identities in Iron Age Veneto"; Perego et al., "Child Personhood in Iron Age Veneto."

19 Perego and Scopacasa, "Micro-Dynamics of Crisis", with bibliography.

20 Luigi Preti, *Le Lotte Agrarie nella Val Padana* (Turin: Einaudi, 1973); Cenni, *Verona.*

and eighteenth centuries, such as in Ravenna, Emilia-Romagna, south of the Po river.[21] Therefore, one key question pertains to the apparent intensification of inequality in Veneto from the seventh to the sixth century BCE and to what extent it was catalysed by broader climatic and environmental changes, which may have contributed to new challenges, including the floods and poorer health in the population, with some notable child mortality. A critical issue is whether the floods in Iron Age Veneto resulted mainly from human interference such as deforestation, which may have increased the runoff of rainwater into the plain, or if it was instead a consequence of climate forcing, such as the so-called "eighth century BC cooling event": this was an apparently severe decrease in solar activity, which would have led to colder and wetter weather across the Mediterranean basin.[22]

4 Case study II: Hellenistic Daunia

Our second case study moves us further south into Daunia and ahead in time to the Hellenistic period, when the region housed a number of large, nucleated centres, including the site of Canusium in the Ofanto river valley.[23]

Field surveys conducted during the last few decades documented an apparent sharp increase in the number of rural sites around Canusium, beginning around the late fourth century BCE. A total of 119 sites dating c. 325–200 BCE were identified, as opposed to 33 sites from the preceding period (c. 600–325 BCE). Most of the sites from the fourth to the third century were characterized by the survey team as "houses" (*case*) or "small farms" (*fattorie*) in view of their size, location, and surface finds; these generally consisted of building materials (for example, large *tufo* or limestone blocks, plaster, brick, tile, and occasionally marble slabs), tools (loom weights and artefacts identified as millstones), and pottery fragments covering areas of around 300–1000 sq m. The conspicuous presence of tableware among the pottery suggests that these sites were permanently settled. Most of these sites apparently continued to be frequented into the second century BCE and later, as indicated by datable pottery such as sigillata wares.[24]

21 De Luca et al., "Heal the Sick: Health Status and Caregiving During the 17th–18th Century in Northern Italy (St. Biagio Cemetery, Ravenna)," *American Journal of Biological Archaeology* 182 (2023): 1–16.

22 Sturt W. Manning, "The Roman World and Climate: Context, Relevance of Climate Change, and Some Issues," in *The Ancient Mediterranean Environment between Science and History*, ed. William V. Harris (Leiden: Brill, 2013): 105–70.

23 Perego and Scopacasa, "The Agency of the Displaced?", with bibliography.

24 Data in Roberto Goffredo, "Persistence and Change in Settlement Patterns in the Ofanto Valley Near Canusium and Cannae (Apulia) (late 4th c. B.C.–1st c. A.D.)," *Journal of Roman Archaeology* 23 (2010): 7–33; Perego and Scopacasa, "The Agency of the Displaced?", with figures.

There are indications that at least some of these small rural sites were associated with lower-status social groups with respect to the highest echelons in urban or proto-urban settlements such as Canusium; an example would be the size and structure of the "farms". While few of the surveyed rural sites have thus far been excavated, traces of built structures are simpler and more austere than the élite urban structures in Canusium, although not on the same level as the wattle-and-daub huts from earlier periods. A good example is the excavated house at Madonna di Costantinopoli, which was a one-room, stone-built house with a simple layout, tiled roof, paved floors, and an external beaten-earth courtyard. As regards the surface finds, artefacts identified as millstones, loom weights, and spindle whorls indicate the presence of labourers, settlers, or families engaged in farming and textile production, probably in connection with sheep rearing.[25]

The rapid infilling of the countryside around Canusium can be seen as a local manifestation of the global trend of rural infill that involved Italy during the same period, leading to what scholars have termed the "Hellenistic rural site boom".[26] However, once the available environmental data are factored in, a potentially different side to this process seems to emerge in Daunia. This is because the infilling of the countryside around Canusium apparently involved arid-prone areas that were especially sensitive to climate shifts and might have been challenging to agriculture: the northern slopes of the Murge plateau and the southern terrace of the Tavoliere plateau. The Tavoliere is one of the driest areas in Italy, with an average yearly rainfall of under 500 mm, and it is currently at high risk of desertification. In summer, the plateau becomes a suntrap, with temperatures occasionally rising over 40 °C. This tendency towards extremes does not appear to be entirely the result of recent climate change: over the last ten millennia, the Tavoliere seems to have periodically deteriorated into a dustbowl.[27] The Murge, on the other hand, is a karst plateau where the soil layer can be relatively thin. While rainfall in recent decades has been moderate, surface water is extremely scarce by current Italian standards – a feature that has affected agriculture in the Murge for centuries. A 2004 study of droughts in twentieth-century Apulia suggested that the Murge and Tavoliere were the two areas where the underground water table was most sensitive to decreases in rainfall, since both areas displayed the greatest drops in the water table in times of drought.[28] Although it is not yet clear to what extent these finds also apply to antiquity, the karst

25 Goffredo, "Persistence and Change in Settlement Patterns"; Perego and Scopacasa, "The Agency of the Displaced?".

26 Nicola Terrenato, *The Early Roman Expansion into Italy: Elite Negotiation and Family Agendas* (Cambridge: Cambridge University Press, 2019).

27 Cyprian Broodbank, *The Making of the Middle Sea* (Oxford: Oxford University Press, 2013).

28 Maurizio Polemio and Vittoria Dragone, "La siccità e la disponibilità di acque sotterranee in Puglia," in *La siccità in Italia,* ed. Accademia Nazionale dei Lincei, Atti dei convegni lincei 204 (Rome: Accademia Nazionale dei Lincei, 2004): 187–93.

terrain of the Murge may have made it a more challenging place for agriculture than the neighbouring Ofanto river valley. Communities seeking to settle in the Murge would have needed to develop strategies to reach the underground water table, which might have been contaminated to some degree by seawater infiltration.

As regards our period of interest, the late third and second centuries BCE roughly coincide with the onset of the so-called *Roman Warm Period* (RWP), also known as the *Roman Climate Optimum* (RCO). This is recognized as a phase of warmer temperatures in Italy and many parts of the Mediterranean.[29] The climate data for Hellenistic Italy remain fragmentary, largely because of the low chronological resolution of the available climate records. Nevertheless, the onset of the RWP has been identified in a number of proxy climate records, including the GISP2 ice cores from Greenland, lake level oscillations in central Italy, marine sediment cores from the Adriatic, stalagmite records from north Italy, and Alpine glacier movements. Specialists in ancient Mediterranean climate, such as Robert Sallares and Carlo Giraudi, have argued that temperatures in Italy during the RWP may not have been too different from those of recent decades.[30] If accurate, this could mean that the Tavoliere might have been facing a desertification threat when the rural site boom occurred. While arable farming would still have been possible, communities wishing to settle there may have had to rely on a very fine margin of climatic stability. Additionally, the karst nature of the Murge plateau may have aggravated the effects of warmer temperatures. Yet, it was in this overall potentially challenging climatic context that these two drought-sensitive plateaus seem to have attracted an unprecedented number of small rural sites.

Any attempt to integrate the environmental and climate data with the archaeological record needs to deal with methodological obstacles. As already mentioned, one major issue with the climate data is the low chronological resolution. Nevertheless, it is not implausible that the incomers to the Tavoliere and Murge included non-élite families that had been compelled to move into, and remain in, lands that might have been previously regarded as sub-prime. From this angle, the increase in rural sites may to some extent indicate the intensification of social inequality and hierarchy, as a sector of the population may have been pushed out of the city and the well-watered river valley, perhaps to make way for larger, élite-controlled estates. Alternatively, people may have moved into the arid-prone lands because they were motivated, or forced, to exploit a wider range of the local ecosystem, possibly to satisfy growing surplus demands from the urban élites. There is some indication that the rural infilling from the late fourth to the third century BCE took place in a context of high social inequality. By the late third century, Canusium was home to some exceptionally well-

29 Manning, "The Roman World and Climate": 134–35.

30 Robert Sallares, "Ecology," in *The Cambridge Economic History of the Greco-Roman World*, ed. Walter Scheidel et al. (Cambridge: Cambridge University Press, 2007): 13–37; Carlo Giraudi, "Coarse Sediments in Northern Apennine Peat Bogs and Lakes: New Data for the Record of Holocene Alluvial Phases in Peninsular Italy," *The Holocene* 24 (2014): 932–43.

off families, such as that of the noblewoman Busa, who reportedly fed, clothed, and paid ten thousand survivors from the Roman ranks after the battle of Cannae in 216 BCE.[31] Élite families such as Busa's seem to have adopted the city as their main area of activity, given the high level of investment in urban development and display during the Hellenistic period. These same élites probably derived their wealth from the use, or exploitation, of resources and labour in the local countryside, where the small rural sites were increasing in number. If that was the case, some of the small rural sites around Canusium could have been occupied by tenant farmers and sharecroppers – although we should not rule out the possibility that more independent smallholding peasants were also present. As a comparison, an excavation of small farms in the countryside around Metaponto suggested a prosperous and independent economic profile for these units; the future excavation of the rural sites around Canusium might yield a similar scenario.[32]

Therefore, rather than indicating a breakdown of rural society, the data in our case study potentially indicate a scenario where non-élite people might have borne the brunt of climatic instabilities, possibly developing new strategies to tackle the less-than-ideal environments which they had been compelled to occupy in increasing numbers. They may have done so by resorting to farming strategies that were better suited to warmer and potentially drier environmental conditions, which appears to have been the case in earlier periods in Italy. For example, towards the end of the Late Bronze Age, the Terramare civilization in the Po plain saw an increase in goat faunal remains at the expense of pigs in a context of increasing aridity.[33]

5 Discussion

The proposed case studies highlight that a better understanding of the complex interplay between climate change, environmental stress, and inequality is possible, but a number of challenges need to be addressed:

1. First, *chronology is key to determining the existence of a connection between social developments and specific climate/environmental events*. It remains to be better defined to what extent climatic and environmental stress is contemporaneous with or directly linked to the evidence for inequality and increased hierarchization in our case studies. Certainly, the floods in Veneto were stratigraphically linked, at the

31 Livy 22, 52, 7.

32 We owe this suggestion to an anonymous reviewer.

33 Andrea Cardarelli, "The Collapse of the Terramare Culture and Growth of New Economic and Social System during the Late Bronze Age in Italy," in *Le Ragioni del Cambiamento: Atti del Convegno Internazionale, Roma 2006*, ed. Alberto Cazzella, Andrea Cardarelli, Marcella Frangipane and Renato Peroni (Rome: Edizioni Quasar, 2010): 469.

micro-scale, to specific events in the sites of Este and Padua. Yet, the broader climatic picture of Iron Age Veneto remains to be better understood. In general, the climate data available for ancient Italy vary considerably in terms of chronological resolution: new and more refined methods develop at a quick pace, such that published data may rapidly become obsolete. Proxies such as lake and marine sediment cores tend to have a lower chronological resolution, making them more difficult to correlate with known archaeological and historical events. On the other hand, key archaeological evidence from both contexts discussed in this chapter is dated on the basis of object typologies like pottery types. It is unclear to what extent the pottery-based dates are in tune with recent breakthroughs in dendrochronology and the most recent radiocarbon calibration curve. Therefore, the gathering of any newly available climate evidence from the study areas is a first step towards understanding the wider chronological relationship between environmental stress and inequality – along with any potential links to wider historical events and dynamics beyond the regions under study.

2. Second, we need *a clearer understanding of the climate forcing factors and environmental stress at work in the study areas*. The evaluation of past climate and environmental change is complicated by the fragmentary proxy evidence available:

a. Different proxy records may provide different and sometimes conflicting information on climate and environmental events in a given area, depending on the methods used in individual studies;
b. Some of the proxy data for the study areas originate from outside Europe. This problem also affects studies of climatic and environmental stresses in the Roman Empire[34] and other contexts worldwide;[35]
c. Scholars studying the social impact of climate change often need to combine proxy records from different areas by setting up "multi-proxy" datasets. Even if a given temperature oscillation in Greenland, for example, can be seen to occur in Europe or the Mediterranean as well, the local effects of such a broad climate trend can vary considerably – depending on factors like regional climate, vegetation, and local hydrological budgets. A key step, therefore, is to put together a multi-proxy climate dataset that will serve as a background framework of climate and environmental stresses for a study area.

3. Third, *more clarity is needed regarding the nature of the environmental challenges in the study areas, and their possible causes (for example, climate forcing vs. human interfer-*

34 Michael McCormick et al., "Climate Change During and After the Roman Empire: Reconstructing the Past From Scientific and Historical Evidence," *Journal of Interdisciplinary History* 43 (2012): 169–220.

35 For example, Pingzhong Zhang et al., "A Test of Climate, Sun, and Culture Relationships from an 1810-Year Chinese Cave Record," *Science* 322 (2008): 940–42, http://dx.doi.org/10.1126/science.1163965; Douglas Kennett et al., "Development and Disintegration of Maya Political Systems in Response to Climate Change," *Science* 338 (2012): 788–91, http://dx.doi.org/10.1126/science.1226299.

ence). As a case in point, increased flooding recorded in the stratigraphy of Iron Age Veneto sites seems to coincide roughly with accelerated changes – including the reorganization of funerary spaces. Yet, it remains unclear whether the floods resulted from climate forcing (for example, the "eighth century BC cooling event") or from human activities such as deforestation or building activity, which may have increased rainwater runoff into the plain or a settlement. The complex interplay between anthropic and climate factors seems evident in historically documented floods in modern Veneto, like the 1882 Adige event. Therefore, a detailed assessment of climate forcing vs. human interference is crucial for understanding how the turning points in the study areas may have, or not, resulted from *climatic* change.

4. Fourth, *we need to assess the social and environmental vulnerability of communities in the study areas, including any relation to power dynamics.* This involves considering the complex interplay between environmental and social stress, beyond any simple cause-and-effect scheme. Human societies respond differently to climatic and environmental events, depending on pre-existing socio-political structures, cultural values, economic systems, and even the general health status of a population.[36] It may be tempting, for example, to regard droughts and flooding as events that lead to economic and social breakdown; in practice, however, much depends on localized environmental vulnerability and the coping mechanisms in place. In both Veneto and Daunia, potentially destructive environmental phenomena, like fluvial instability, climate oscillations, and natural disaster at the micro-scale, contributed to social dynamics where less prominent social groups could have played different, complex roles: from marginalized individuals pushed into conditions of severe dependency and subordination, to resourceful social agents who took advantage of changing climate conditions and specific environmental events in order to re-arrange social hierarchies and ameliorate their socio-economic position. This could be the case, for example, with the better-off deceased from Este Ricovero Tumulus L in Veneto, particularly with respect to other individuals from the same period who had been denied more elaborate burial rituals – or who even present evidence of marginalization. The same could be said of some – or even many – settlers in the Daunia rural sites, assuming they were able to make the most of the apparently hostile environment they occupied: for example, through innovative farming techniques or by achieving a more independent lifestyle in a less densely populated landscape, which was geographically detached from the city.

5. Lastly, *we need a sophisticated approach to identifying the link between health, environmental stress, and social dynamics, including extreme marginalization, while accounting for confounding factors.* Bioarchaeological evidence from Veneto, for example,

36 For example, Bruce M.S. Campbell, *The Great Transition: Climate, Disease and Society in the Late-Medieval World* (Cambridge: Cambridge University Press, 2016).

points to cases of poor health, premature death in infancy to childhood, and potential disability among those who received unusual or anomalous deposition rites at the time of the floods.[37] Recent biomedical and epidemiological research has drawn attention to key links between environmental events – including climate change, floods, and drought – and general health, immune system function, and epidemics. For example, climate instability has been suggested to affect susceptibility to infectious and noncommunicable diseases in both humans and animals.[38] Poor nutrition in more challenging ecosystems affected by inequalities could also have been a factor at play, just as it was in north Italy in the nineteenth century of the modern era, as discussed above with regard to pellagra in Veneto; similarly complex dynamics between health, famine, and riverine instability were documented in Ravenna in the seventeenth and eighteenth centuries. More fine-grained bioarchaeological datasets would be necessary, therefore, to investigate whether the environmental events documented in our case studies could have affected health dynamics, with downstream effects on socio-economic change, instability, and more overt inequalities in the ritual sphere of Veneto. Topics of interest would include – but not be limited to – an increase or decrease in the disease burden, childhood mortality, and disability across different segments of the population, as well as livestock health and productivity.

6 Conclusion

Inequality and marginality are complex social phenomena. Environmental factors and climate shifts are known to have a significant impact on such social phenomena, especially in crisis periods. This interaction, however, remains comparatively less studied for late prehistoric and early Roman Italy – with particular regard to the micro-scale, health, and non-élite social groups. In this chapter, we used two case studies from Iron Age Veneto and Hellenistic Daunia to address some key questions as regards the complex interplay between environmental dynamics and social inequality. We showed that in 650–575 BCE Veneto, flooding was connected to social transformations and forms of social exclusion, which can be traced to the micro-scale of single burial groups. In Hellenistic Daunia, on the other hand, environmentally challenging, arid-prone areas in the Tavoliere and Murge seem to have witnessed an

37 Perego, "Inequality, Abuse and Increased Socio-Political Complexity"; Gamba and Voltolini, "L'inumazione presso i Veneti"; Tamorri, "Taphonomic Approaches"; Perego et al., "Marginal Identities in Iron Age Veneto"; Perego et al., "Child Personhood in Iron Age Veneto", with bibliography; burial data remain scantier for the Daunia case.

38 For example, Joel F. Filipe et al., "Floods, Hurricanes, and Other Catastrophes: A Challenge for the Immune System of Livestock and Other Animals," *Frontiers in Veterinary Science* 7 (2020): 16; Camilo Mora et al., "Over Half of Known Human Pathogenic Diseases Can Be Aggravated by Climate Change," *Nature Climate Change* 12 (2022): 869–75.

infilling of new rural sites during a phase of warming. This infilling was potentially driven by non-élite groups. Environmental stress events, as we showed, can lead to unexpected outcomes, such as the occupation, use, or exploitation of challenging ecosystems, rather than to the breakdown of society. A better understanding of such phenomena, however, cannot disregard a number of key questions about methods, data collection, and the use of environmental proxies, as we outlined in our discussion of the case studies.

We therefore hope that our work will contribute to further research on the interplay between social and environmental dynamics in the ancient Mediterranean, with a focus on non-élite and marginalized communities.

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