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ARCHAEOLOGICAL MAPPING

MAPPING HINTERLAND RESOURCES IN THE RURAL LANDSCAPE OF GREEK POLEIS ISTROS AND TOMIS DURING THE ROMAN PERIOD

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Abstract: Mapping the rural territories of two Greek poleis in the Roman province of Moesia Inferior (Romania and Bulgaria) is essential for understanding their agricultural potential and the patterns of urban expansion or retreat during the 1st–3rd centuries AD. This study investigates the location of rural sites through field research, considering geography, soil quality, and proximity to resources, roads, and water sources. The goal is to identify the criteria Roman farmers used when selecting sites and to determine which resources were considered most desirable. For instance, do more sites appear on a particular geological type simply because it covers the largest area, or was its selection intentional? By analysing these patterns, we can assess site preferences and settlement dynamics. Geographic Information Systems (GIS) have transformed archaeological research by enabling spatial analysis, predictive modelling, and landscape reconstruction. This paper examines GIS applications in site detection, environmental reconstruction, and cultural landscape analysis while addressing associated challenges and future directions. Integrating GIS with remote sensing, artificial intelligence, and big data analytics can further enhance archaeological methodologies and provide new insights into past human activities.

Keywords: *Rural landscape; hinterland resources; agricultural potential; Moesia Inferior; Roman Empire.*

INTRODUCTION

Landscape archaeology is an interdisciplinary field that examines the interactions between humans and their environment over time. Unlike traditional archaeology, which often focuses on individual sites and artefacts, landscape archaeology considers broader spatial patterns, land use, and environmental changes to reconstruct past societies' ways of life.¹ It integrates data from geography, geology, remote sensing, and historical sources to analyse how human activity has shaped—and been shaped by—landscapes over millennia.²

The advent of GIS has transformed archaeological research by providing spatial tools for analysing site distribution, landscape modifications, and human-environment interactions.³ GIS enables archaeologists to integrate

¹ ZIMMERMANN 2021.

² FOWLER 2021.

³ CONNOLLY/LAKE 2006.

multiple datasets, including topographic, environmental, and cultural information, into comprehensive spatial analyses.⁴ It facilitates the reconstruction of ancient landscapes by incorporating environmental data such as climate records, vegetation cover, and hydrological networks. Digital Elevation Models (DEMs) allow archaeologists to simulate past terrains, offering insights into settlement distribution and agricultural practices.⁵ Hydrological analysis, for instance, has been used to study ancient irrigation systems and water management strategies.⁶ View shed analysis in GIS helps determine site visibility, shedding light on defensive strategies and ritual landscapes.⁷ Least-cost path analysis, another GIS tool, models ancient routes based on terrain difficulty, enabling researchers to reconstruct trade and migration networks.⁸

This paper examines the key applications of GIS in archaeology, its challenges, and future directions in the field. The research is based on the hypothesis that ancient settlements were primarily sustained by agricultural production. We aim to study the implications of rural settlement sites in the hinterland of two Greek *poleis*, respectively Istros and Tomis, to assess their agricultural potential and trace urban expansion or retreat during the 1st–3rd centuries AD. The main objective is to identify the criteria Roman farmers used in selecting settlement locations within the study area. However, determining site placement relative to natural resources can help reveal which factors were considered most desirable during the Roman period. For example, do more sites appear on a specific geological type simply because it covers the largest area, or was its selection deliberate? By applying techniques such as GIS mapping and paleoenvironmental analysis, researchers in the West Pontic (Black Sea) region are uncovering new insights into ancient settlements, trade routes, and human adaptation to environmental changes. This approach enhances our understanding of long-term human-environment dynamics and contributes to broader archaeological research.

REGIONAL SETTING

One of the key regions for landscape archaeology in Eastern Europe is the West Pontic area of Romania, which extends along the western coast of the Black Sea. This region contains significant archaeological sites from various ancient periods, reflecting its long history of human settlement and interaction. Its strategic location facilitated trade, cultural exchange, and military activities, particularly during Greek colonization, Roman rule, and the medieval period.⁹ Coastal erosion, river systems, and climate fluctuations have significantly shaped the archaeological record, making the area an ideal case study for landscape archaeology.¹⁰

Istros, one of the most important sites in the region, has been the focus of extensive archaeological research. Studies

on its urban development¹¹ and modern 3D reconstructions of its structures¹² have provided valuable historical insights (Fig. 1A). Tomis, the ancient city now known as Constanța, Romania, was a major Greek and later Roman settlement on the western coast of the Black Sea (Fig. 1B).

GIS-based archaeological research in Tomis and Istros has significantly enhanced our understanding of its urban layout, trade networks, and interaction with the surrounding landscape. Recent studies have used GIS-based spatial analysis to reconstruct its ancient topography by integrating historical maps, LiDAR data, and remote sensing imagery.¹³ These methods have revealed buried structures, street networks, and coastal changes that influenced the city's development. Predictive modelling has been particularly effective in identifying potential archaeological sites around the city and its hinterland.¹⁴ Additionally, GIS-based hydrological and environmental modelling has provided insights into how the inhabitants of Tomis managed water resources, particularly the aqueduct systems supplying the city.¹⁵ Viewshed analysis has also contributed to understanding defensive strategies and urban planning, highlighting the strategic placement of fortifications overlooking the Black Sea.¹⁶

The region's paleoenvironmental characteristics are crucial for analysing the economic potential of settlements. Relief and hydrography largely determine the agricultural potential of the land in the study area. Even a quick glance at a physical map suggests that towns located in the Danube Valley and along major rivers had greater agricultural potential than those in the mountainous western half of the peninsula, despite similar economic orientations. While mountains and marshes provided valuable resources such as pasture, forests, and fisheries, these were likely complementary to the local agricultural economy.¹⁷

Today, the study area is predominantly lowland, with minimal elevation variations. The highest altitudes barely exceed 400 meters, making elevation an unlikely factor in agricultural activity; instead, slope plays a more significant role. Istros, now about 7 km from the sea, is part of the Razim-Sinoe Lagoon Complex and is one of the best-documented coastal areas in terms of paleoenvironmental evolution and human-environment interactions. The proximity of the Danube and its delta, along with the region's rich natural resources—including iron deposits,¹⁸ copper,¹⁹ stone quarries, and fertile soil—were key factors in the Milesians' decision to establish a settlement here (Fig. 1).²⁰

The boundaries of Roman Istros' territory were defined and preserved in the chorothesia of Ti. Laberius Maximus. Although interpretations of this inscription have been debated, Avram's and Matei-Popescu's arguments²¹ remain widely accepted today, suggesting the region extended at

⁴ KYAMME 1999.

⁵ DINCAUZE 2000.

⁶ GAFFNEY/STANČIĆ 1991.

⁷ LLOBERA 2003.

⁸ HOWEY 2007.

⁹ ANGELESCU 2019.

¹⁰ PRICE 1993.

¹¹ ALEXANDRESCU/SCHULLER 1990.

¹² SUCEVEANU/ANGELESCU 2004.

¹³ CHASE *et alii* 2011; NEGULA *et. al.* 2020.

¹⁴ DAMIAN/GEORGESCU 2019.

¹⁵ ȘTEFAN *et. al.* 2021.

¹⁶ POPESCU/RUSU 2018.

¹⁷ DONEV 2019.

¹⁸ BOUNEGRU *et alii* 2009; PANAIT 2014, 50.

¹⁹ PANAIT 2014, 50; MIHAILESCU-BÎRLIBA 2016.

²⁰ ANGELESCU 2005.

²¹ AVRAM 1990; MATEI-POPESCU 2013, 211–215.

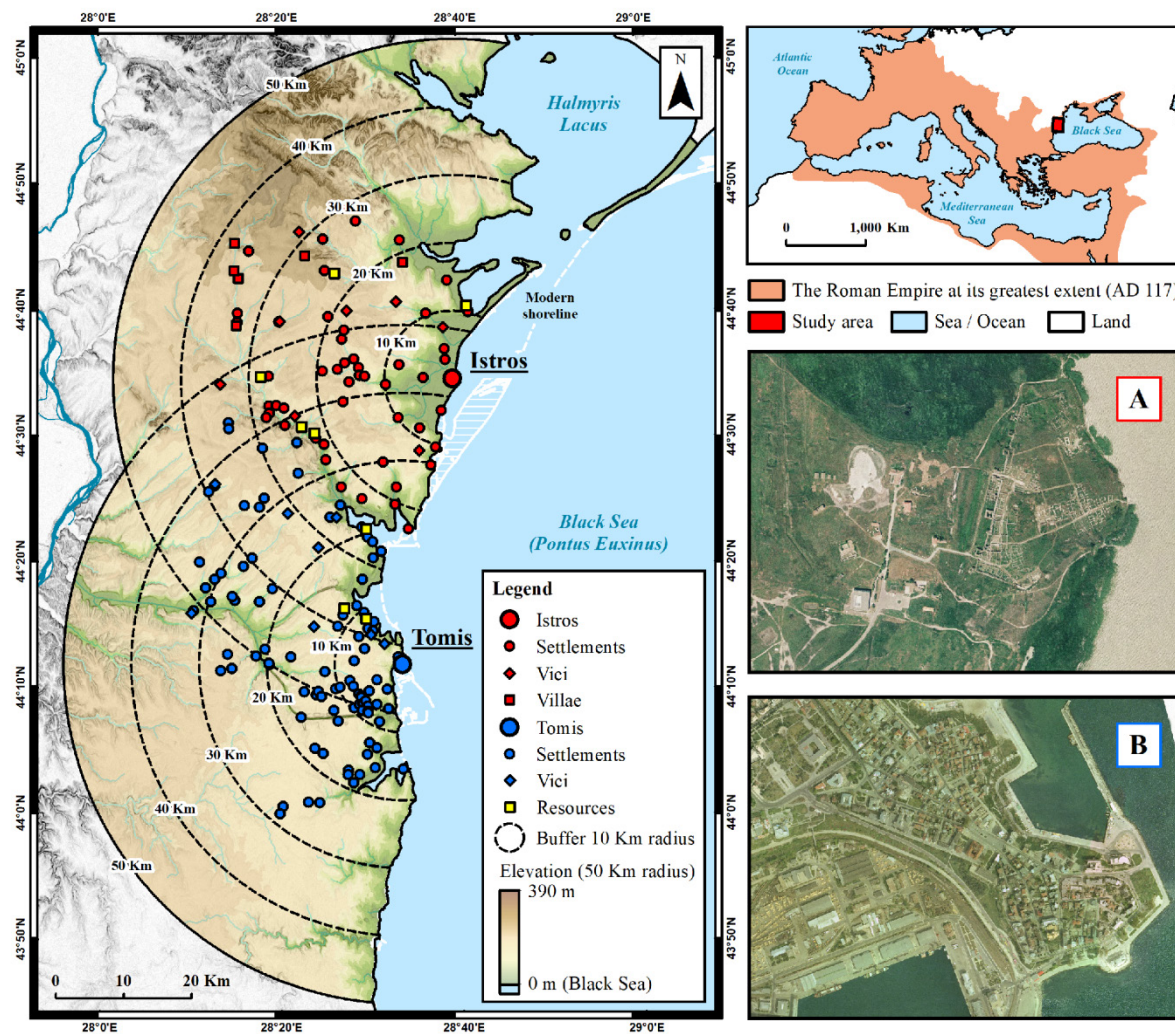


Fig. 1. Geographical locations of (A) the Roman city of Istros and (B) the Roman city of Tomis, along with their associated rural settlements (within a 50 km radius on land around the cities) on the reconstructed western coastline of the Black Sea (*Pontus Euxinus*) (MIHU-PINTILIE/DUMITRACHE 2023). The modern shoreline configuration is indicated in the main map.

least 30 km from the polis.²² However, the chora of Tomis lies south of Istros hinterland. Geographically, the Tomis area consists of a succession of low-altitude hills and plateaus, with most of the region lying below 100 m. The hydrographic network includes important sources of groundwater and surface water. The soils classes with medium textures (clayey or loamy-sandy), are highly permeable and possess favourable physical properties for agriculture.²³

MATERIALS AND METHODS

1. ARCHAEOLOGICAL DATA OCCURRENCE

As part of our research, we developed a structured database of archaeological sites from the Roman period in the regions of Istros (Table 1 and Table 2) and Tomis (Table 3 and Table 4). Our approach follows the updated cIMeC records, the Archaeological National Repertoire of Romania (RAN), and the ArchTerr platform, corroborated with epigraphic data on vici and villae, excavation reports, and published

results from non-invasive field research, similar to studies conducted in Eastern Roman Spain.²⁴

The database was designed to facilitate spatial analysis by integrating multiple data sources, including historical records, excavation reports,²⁵ and epigraphic evidence.²⁶ Its key organizational principles include: (1) Site classification: each entry is categorized by site type (rural site, vicus, or villa); (2) Chronological attribution: only sites confirmed as belonging to the Roman period were included to ensure a focused study.

Archaeological and epigraphic evidence reveal the presence of eight vici, six villae, 49 settlements, and five resource sites in the territory of Istros (Table 5). In the area of Tomis six vici, 95 settlements, and three resource sites have been identified (Table 5).

²⁴ GRAU MIRA 2022.

²⁵ STREINU 2007.

²⁶ BĂRBULESCU 2001; BĂLTĂC 2011; MIHAILESCU-BÎRLIBA 2018, 19–68, BÎRZESCU/RABINOWITZ 2021.

²² MATTHEWS 2018.

²³ LIXĂNDESCU *et alii* 2022.

Table 1. Vici and villae in the rural territory of Istros

	Location	References
Vici		
vicus Quintionis	Sinoe, Constanta county	ISM I, 324–332
vicus V(...)	Ramnicu de Jos, Cogealac, Constanta county	CIL III, 14442
?	Neatarnarea, Beidaud, Tulcea county	ISM I, 368
Buteridavensis	Mihai Viteazu, Constanta county	ISM I, 359–360
Casianus	Casian, Gradina, Constanta county	ISM I, 369–370
Celeris	Vadu, Constanta county	ISM I, 351, 352
?	Fantanele, Constanta county	Suceveanu 1998: 124–125
Ulmetum	Pantelimon, Constanta county	RAN 62618.01
Villae		
Lucius Pompeius Valens	Nistoresti, Pantilimon, Constanta county	ISM I, 373
Messia Pudentilla	Between Baia, Tulcea County and Mihai Viteazu, Constanta county	ISM, I, 359, 360
Casimcea 1	at 1950 m south of Casimcea, Tulcea county	RAN 159972.299
Casimcea 2	Casimcea, 400 m north of Casimcea village, 300 m north of Casimcea river, northeast of Colțanii Dulbencii	RAN 159972.01
Casimcea 3	2.5 km S of the village, on the terrace on the right bank of the Casimcea river, S of DJ Casimcea- Sarighiol de Deal	RAN 159972.02
Sarighiol de Deal	Sarighiol de Deal, Tulcea county, 3 km N, towards the village of Neatarnarea	RAN 159874.01

Table 2. Rural sites in the rural territory of Istros

Sites	cod RAN	Period
Baia 1	159794.02	roman
Baia 2	Bărbulescu 2001: 38	roman
Beidaud	159856.04	roman
Caraburun-Acic Suat	159794.09	II–III AD
Casian 1	63009.06	roman
Casimcea	159972.06	sec. I–III
Ceamurlia de Sus	159829.01	roman
Cheia 1	63018.04	roman
Cheia 2	63018.03	roman
Cheia 3	63018.01	roman
Cheia 4	63018.05	roman
Cogealac 1	61381.01	I–III AD
Cogealac 2	61381.02	roman
Cogealac 3	61381.04	roman
Cogealac 4	61381.04	I–III AD
Corbu 1	61522.03	III–IV
Corbu 2	61522.02	I–VI
Corbu 3	Bărbulescu 2001: 46	roman
Corbu 4	61522.04	I–IV
Fantanele 1	61407.01	roman
Fantanele 2	Suceveanu 1998: 124–125	roman
Fantanele 3	Suceveanu 1998: 124–125	roman
Gradina	63027.01	III–IV
Gura Dobrogei	61416.02	I–III
Istria 1	62039.10	roman
Istria 2	62039.13	I–III AD
Istria 3	62039.06	I–VI AD
Istria 4	62039.05	II–III AD
Nistoresti 1	62636.02	III–IV
Nistoresti 2	62636.01	I–VI
Nunțași	62048.02	II–III AD
NV Lake Tasaul Laikos Pyrgos?	Bărbulescu 2001: 156	roman
Palazul Mic 1	Bărbulescu 2001: 45	roman
Palazul Mic 2	62226.01	I–III

Sites	cod RAN	Period
Piatra	Bărbulescu 2001: 45	roman
Ramnicu de Jos – Chirișlic	61425.01	I–III
Sacele	62887.02	I–III
Sarighiol	159874.03	II–III
Sinoe 1	62271.01	III–IV AD
Sinoe 2	62271.02	roman
Tariverde 1	61443.04	roman
Tariverde 2	61443.01	III–IV
Tariverde 3	61443.05	roman
Tariverde 4	61443.07	roman
Traian 1	Bărbulescu 2001: 45	roman
Traian 2	62896.02	I–IV
Vadu 1	61540.03	II–III
Vadu 2	61540.06	II–IV
Vadu 3	61540.05	II–IV

Table 3. Vici in the rural territory of Tomis

Vici	Location	References
Clementianensis	Mihail Kogălniceanu, Constanta county	ISM II 160, 191
Turris Muca(...)	Anadolchioi district in Constanta	ISM II, 141
Sc[apt]ia	Palazu and Anadolchioi	ISM II, 137
Urb?(...)	Medgidia?, Constanta county	ISM IV, 242
Narcissiani	Poiana?, Constanta county	ISM II, 133
Apolloniou	near Tomis	Bărbulescu 2001: 158

Table 4. Rural sites in the rural territory of Tomis

Sites	cod RAN	Period
Agigea 1	63269.03	roman
Agigea 2	63269.01	roman
Agigea 3	63269.06	II–III AD
Biruința 1	63107.01	I–IV AD
Biruința 2	63107.28	roman
Castelu 1	61130.16	roman
Castelu 2	61130.03	I–IV AD
Castelu 3	61130.02	I–IV AD
Constanta 1	60428.39	II–IV AD
Constanta 2	60428.30	II–III AD
Constanta 3	60428.17	I–III AD
Constanta 4	60428.36	II–IV AD
Constanta 5	60428.34	II–III AD
Constanta 6	60428.35	II–IV AD
Constanta 7	60428.38	II–III AD
Constanta 8	60428.44	II–III AD
Cumpana 1	61639.43	I–III AD
Cumpana 2	61639.38	II–III AD
Cumpana 3	61639.37	II–III AD
Cumpana 4	61639.36	II–III AD
Cumpana 5	61639.30	II–III AD
Cumpana 6	61639.29	II–IV AD
Cumpana 7	61639.24	II–III AD
Cumpana 8	61639.21	II–III AD
Cumpana 9	61639.20	II–III AD
Cumpana 10	61639.19	II–III AD
Cumpana 11	61639.01	II–IV AD
Cumpana 12	61639.16	II AD
Cumpana 13	61639.15	II–III AD

Sites	cod RAN	Period
Cumpana 14	61639.14	II–III AD
Cumpana 15	61639.12	II–III AD
Cumpana 16	61639.10	roman
Cumpana 17	61639.07	II–III AD
Cumpana 18	61639.06	I–III AD
Cuza Voda 1	61149.07	II–IV AD
Cuza Voda 2	61149.06	roman
Cuza Voda 3	61149.02	roman
Cuza Voda 4	61149.05	II–III AD
Cuza Voda 5	CT-CUZA-VODĂ-NE-004	roman
Eforie Sud	60464.01	II–IV AD
Lazu 1	60589.08	II–III AD
Lazu 2	60589.07	II–III AD
Lazu 3	60589.03	II–IV AD
Lazu 4	60589.01	II–VI AD
Medgidia 1	60856.12	roman
Medgidia 2	60856.10	I–II AD
Mireasa 1	Bărbulescu 2001: 293	roman
Mireasa 2	Bărbulescu 2001: 293	roman
Movilita 1	63116.01	I–IV AD
Movilita 2	63116.16	roman
Murfatlar 1	62379.05	roman
Murfatlar 2	CT-MURFATLAR-SIMINOC-018	roman
Murfatlar 3	62379.04	roman
Murfatlar 4	CT-MURFATLAR-SIMINOC-NV-016	roman
Navodari 1	60516.04	I–III AD
Navodari 2	CT-NĂVODARI-007	roman
Navodari 3	CT-NĂVODARI-003	roman
Navodari 4	60516.01	I–III AD
Navodari 5	60516.06	roman
Nicolae Balcescu 1	Bărbulescu 2001: 293	roman
Nicolae Balcescu 2	CT-NICOLAE-BALCESCU-DOROBANTU-001	roman
Nisipari 1	61158.05	II–IV AD
Nisipari 2	61158.01	I–III AD
Ovidiu 1	60696.05	II–IV AD
Ovidiu 2	60696.04	II–III AD
Palazu Mare 1	60446.07	II–III AD
Palazu Mare 2	60446.08	II–III AD
Palazu Mare 3	60446.05	II–III AD
Palazu Mare 4	60446.01	II–III AD
Palazu Mare 5	60446.04	II AD
Poarta Albă	62770.02	roman
Potarnichea	61657.04	roman
Sibioara 1	62244.01	II–III AD
Sibioara 2	Bărbulescu 2001: 51	roman
Siminoc	62388.01	roman
Siutghiol	Bărbulescu 2001: 50	roman
Straja	61666.01	II–III AD
Targusor 1	62994.02	roman
Targusor 2	62994.04	roman
Targusor 3	62994.03	I–III AD
Tasaul Limba oii		roman
Techirghiol 1	60543.04	I–IV AD
Techirghiol 2	60543.03	I–IV AD
Techirghiol 3	60543.02	II–III AD
Techirghiol 4	60543.01	I–IV AD

Sites	cod RAN	Period
Techirghiol 5	60543.09	roman
Topraisar 1	63081.10	roman
Topraisar 2	63081.09	roman
Topraisar 3	63081.03	roman
Topraisar 4	63081.06	roman
Valea Dacilor	60874.01	roman
Valu lui Traian 1	63134.09	I–III AD
Valu lui Traian 2	63134.07	II–IV AD
Valu lui Traian 3	63134.03	II–IV AD
Valu lui Traian 4	63134.08	roman

Table 5. Resources in the rural territory of Istros and Tomis

Resources	Location
Istros	
Iron ores	Southern shore of Lake Zmeica
Iron ores	Casimcea valley
Limestone/stone	Gura Dobrogei
Copper	Altan Tepe
Stone quarry	Grădina
Tomis	
Iron ore	Palazu Mare
Stone quarry	The southern shore of Lake Taşaul
Shale, sandstone and limestone	Ovidiu

2. GIS-based data integration

GIS-based data integration serves as a fundamental component in contemporary spatial analysis and environmental modelling. The fusion of diverse datasets within a Geographic Information System (GIS) platform allows for enhanced spatial visualization, analysis, and decision-making processes. In the context of this study, GIS tools were utilized to compile, overlay, and analyse various types of spatial and non-spatial data, including topographic, hydrologic, soil, and land-use information.

The integration process began with the standardization of datasets to ensure compatibility in terms of coordinate systems, scales, and formats. Raster and vector data were processed and harmonized using ArcGIS software, enabling a seamless overlay of different layers. For instance, Digital Elevation Models (DEMs) were employed to extract slope and aspect information, while land-use maps and soil data were digitized and georeferenced to align with the topographic base map.

Furthermore, the GIS environment facilitated spatial querying and analysis, allowing the researchers to identify critical zones.

The strength of GIS lies not only in its ability to visualize complex spatial patterns but also in its capacity to serve as a platform for multi-criteria decision analysis (MCDA). In this study, GIS-based MCDA was employed to weigh and rank various environmental factors, contributing to a more nuanced understanding of spatial vulnerabilities and potentials.

Moreover, GIS facilitated the development of predictive models, enabling scenario simulations for environmental management and planning of roman rural landscape of

Tomis and Istros. The results generated through GIS integration were validated using field data and statistical analysis, ensuring the reliability and applicability of the findings. Created maps allowed researchers to visualize the spatial distribution of archaeological finds, ancient infrastructure, and historical topography within and around the area of ancient Tomis (modern-day Constanța) and Istros.

Furthermore, the use of ArcGIS facilitated the identification of areas with high archaeological potential, guided future fieldwork, and supported predictive modelling of yet-undiscovered structures based on proximity to known features like roads or other facilities. The project also proved valuable for heritage management and urban planning, ensuring that modern development could be informed by the invisible layers of the past beneath the surface.

RESULTS

The criteria for site selection were closely tied to the natural landscape, productive potential, and the value assigned to various resources at the time. Cato lists several key factors for settling in a rural area (De Agr. 1.2–4), including proximity to water sources, urban centres, and roads. However, it remains unclear which of these factors Roman farmers considered most important. By establishing a hierarchy of these resources in settlement choices, we can gain insight into the diverse economic strategies and motivations behind site locations in this region.

While this analysis has its limitations and potential biases, it offers a valuable method for testing data and reassessing established theories of settlement patterns. Our investigation examined the location of rural sites in relation to geography, soil quality, access to resources, roads, and proximity to water sources, applying a similar approach to that used for the Tongres–Cologne area.²⁷

1. Slope analysis

The slope map supports agronomists' recommendations favouring plains or gentle slopes for agriculture. Columella (Rust. 1.2.4) argues that cultivating steep slopes is impractical, as agricultural work becomes increasingly difficult with steeper gradients.²⁸ However, modern definitions of what constitutes a gentle or moderate slope may not align with ancient conceptions. While south-facing slopes were

²⁷ JENESON 2011.

²⁸ GOODCHILD 2007.

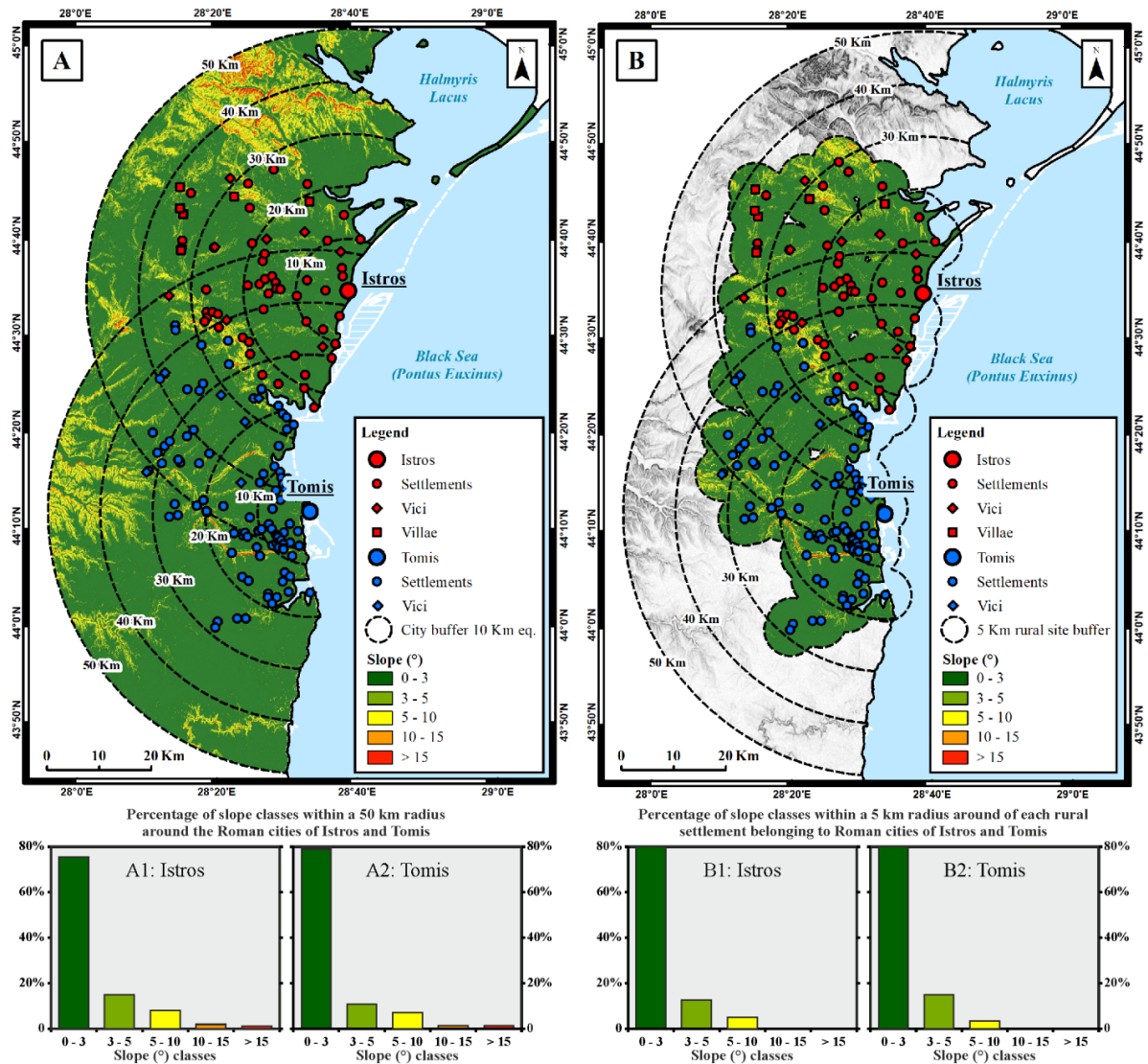


Fig. 2. Slope (°) classes within the study area. Map (A) shows the slope within a 50 km radius around the Roman cities of Istros and Tomis, and map (B) show the slope within a 5 km radius around of each rural settlement.

preferred (Cato, *De Agr.* 1.2), Columella (*Rust.* 1.2.3) also recommended east-facing slopes.

Moreover, the modern terrain does not necessarily reflect the topography of the Roman period, as landscapes evolve due to both natural and human-induced changes. In our analysis, plains were classified as having slopes of 0–3%, while gentle slopes ranged from 3–5%.²⁹ Approximately 80% of rural sites in the two analysed cities are located on plains, with up to 20% situated on gentle slopes of up to 5 degrees (Fig. 2). Only 10% of sites are found in strongly sloping areas, particularly along the boundary between Istros and Tomis, likely indicating suitability for alternative economies such as viticulture or pastoral activities.

2. Soil quality analysis

Our primary sources for estimating the extent of arable land are modern physical relief and contemporary land use. In the Western Balkans, physical relief has remained relatively stable, and in most micro-regions, modern cultivated areas roughly reflect the agricultural potential of the

past.³⁰ However, this does not mean that the modern arable area precisely coincides with the land cultivated in ancient times. We can consider two possible scenarios: (1) current arable land coincides with historical land use, or (2) today’s marginal and depopulated areas may have once been fertile zones that are now abandoned.

All we can do is attempt to determine the hinterland that was potentially arable based on local variations in soil types and fertility. Examining the soil quality map, we find that chernozem soils, rich in humus and highly suitable for agriculture, cover 51% of Dobrogea.³¹ In contrast, chestnut soils are less favourable for agricultural activity. However, the highest concentration of sites on this soil type is found in northeastern Dobrogea, particularly along Razim Lake, where economic activities in ancient settlements were primarily centered around trade and fishing.³² The region with the lowest settlement density, in the northwest, is characterized by a large expanse of brown lessive soil, which is often

³⁰ DONEV 2019.

³¹ MATTHEWS 2018.

³² MATTHEWS 2018.

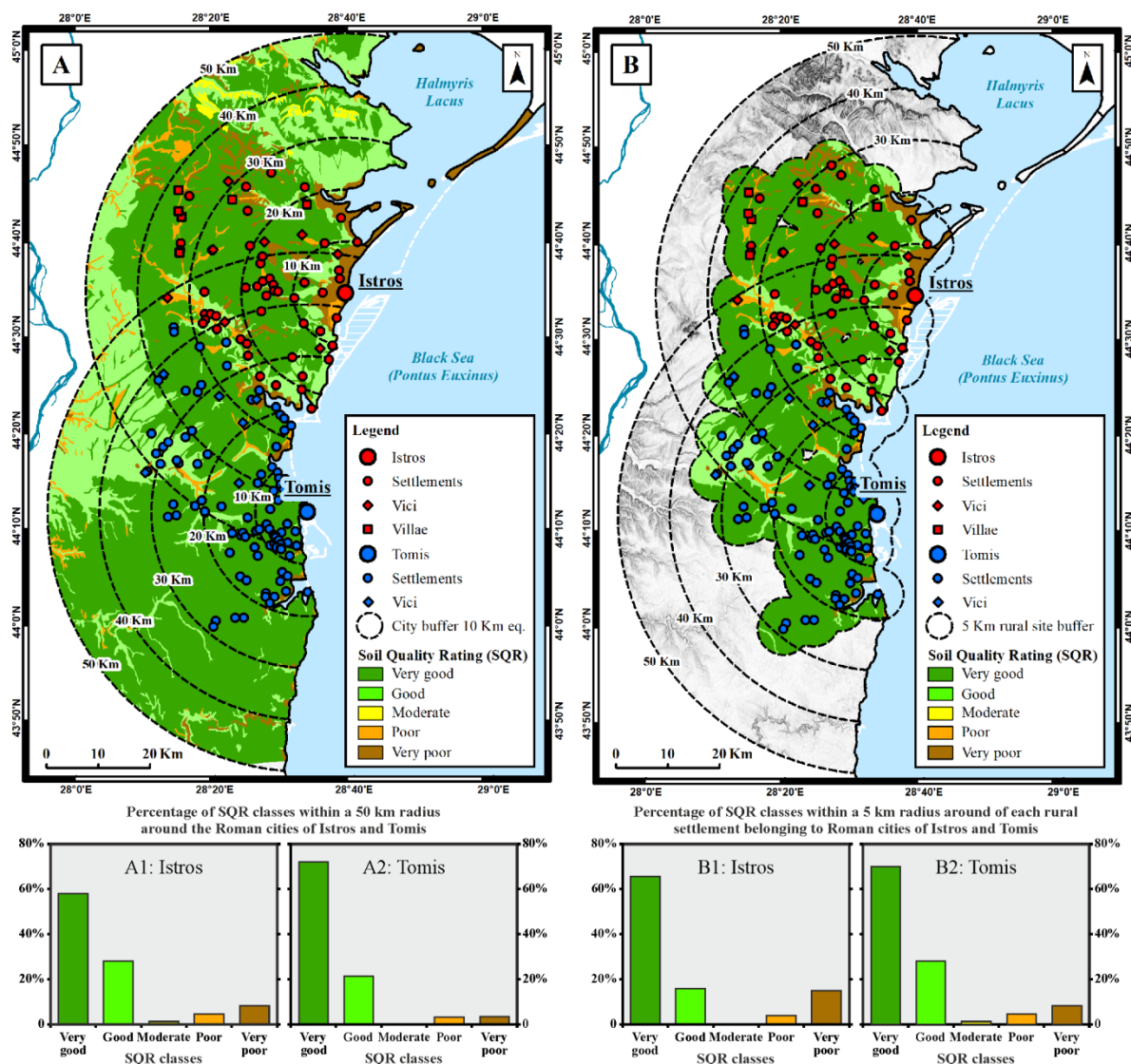


Fig. 3. Soil Quality Rating (SQR) adapted from Panagos *et alii* (2011). Map (A) shows the SQR within a 50 km radius around the Roman cities of Istros and Tomis, and map (B) show the SQR within a 5 km radius around of each rural settlement belonging to Roman cities of Istros and Tomis.

associated with woodland. This area was covered by forests in antiquity, just as it is today.³³ Furthermore, the vici attested around Pantelimon, Râmnicu de Jos, Casimcea, Sarighiol de Deal, and Neatârnaea all lie on fertile chernozem soils. This may have influenced their selection as settlement locations, particularly if agricultural potential played a role before the arrival of the Romans.

The territory of Tomis is covered almost entirely by high-quality soil (Figure 3A). Similarly, the rural territory of Istros is predominantly composed of good and very good soil. Analysing soil quality within 5 km buffers around rural settlements in the Istros territory, we observe that poor soil accounts for 20% of the area (Figure 6B). However, soils have a dynamic nature due to extensive farming, and fertility levels can fluctuate over time.³⁴ Therefore, we cannot be certain that modern soil conditions accurately reflect those of the Roman period. Consequently, relying solely on modern soil data as an indicator of Roman-era agricultural fertility is problematic. Nonetheless, we will use a combination of slope

maps and soil maps to assess potential land use and fertility patterns. By overlaying these two data layers, we conclude that the area has high agricultural potential, considering both soil quality and the predominance of low slopes.

3. Fresh water sources

Fresh water control was a crucial factor in agricultural development in both ancient and modern times, significantly influencing site selection. Additionally, access to navigable rivers was vital for the transport of people and goods. The presence of water would have been a key prerequisite for settlement. When a 1 km buffer was applied around the most significant water sources in Dobrogea, 45% of the sites were found within 1 km of an inland river, while another 13% were within 1 km of the Danube.³⁵ Figure 4A illustrates 1–2 km buffer zones from fresh water sources.

An analysis of the digital coverage of streams and river networks indicates that this region was exceptionally well-served by water sources. Approximately 70% of rural sites in

³³ MATTHEWS 2018.

³⁴ GOODCHILD 2007.

³⁵ MATTHEWS 2018.

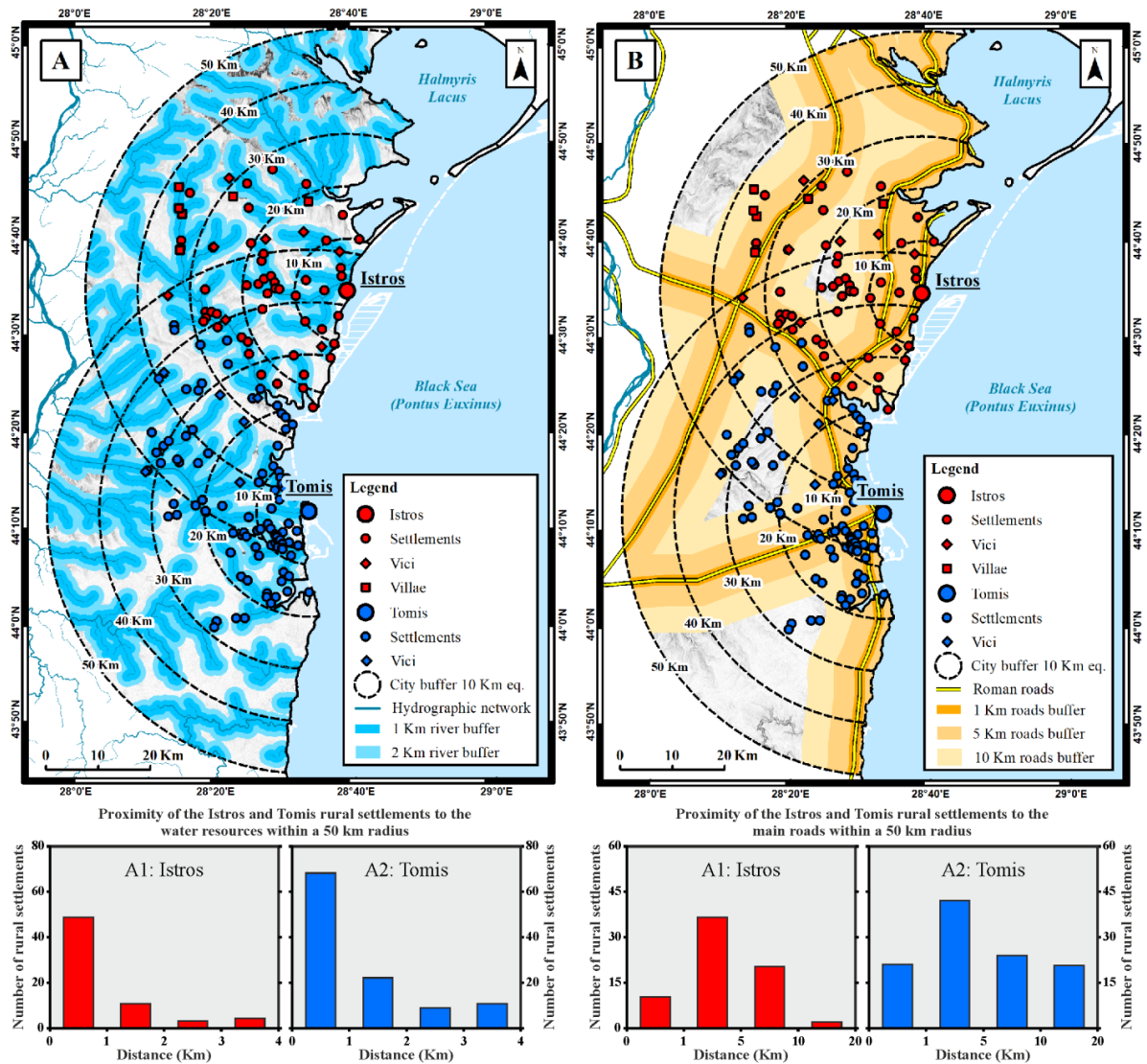


Fig. 4. Proximity of rural settlements to the (A) water resources and (B) main roads within a 50 km radius on land around the Roman cities of Istros and Tomis

the territory of Tomis and 45% of settlements in the Istros chora are concentrated within 1 km of a river source.

4. Proximity to route

The distance from sites to roads was analysed in the same way as that of rivers. We established buffer zones of 1 km, 5 km, and 10 km (Fig. 4B). As shown on the map, the majority of sites were located near communication routes, within a 5 km buffer. Some vici in the area even built and maintained their own roads as part of the *cursus publicus*. This responsibility likely caused grievances, as evidenced by complaints from the inhabitants of Chora Dagei and Laikos Pyrgos, who objected to multiple duties (*munera*).³⁶ Small farms were typically located farther from these networks, such as the two villae in Casimcea. While some exceptions exist beyond the 10 km buffer, these sites are either in close proximity to vici (in the territory of Tomis) or near the 15 km mark from an urban centre (in the territory of Istros).

5. Proximity to town

According to ancient sources, proximity to a town was an important factor in the location of rural sites (Cato De Agr. 1.3). The production of rural farms was intended to support segments of the urban population that were not engaged in agriculture. For this reason, even under ideal conditions, peasants would have travelled only short distances to markets (Goodchild, 2007). This was likely due to transportation costs and the time spent away from the farm, making it more desirable for farm units to be located near market centres.³⁷

Several theories regarding farming and cultivation practices have been proposed. As a result, different models have been developed, such as the consumer city or producer city model,³⁸ as well as geographical models of economic organization, including von Thünen's Isolated State theory³⁹ and Central Place Theory.⁴⁰

Von Thünen's theory divides a city's territory into

³⁷ VON THÜNEN 1842, 1863; GOODCHILD 2013.

³⁸ ERDKAMP 2001.

³⁹ VON THÜNEN 1842, 1863; GOODCHILD 2013.

⁴⁰ CHRISTALLER 1966; DE LIGT 1991; FRAYN 1993; PARR 2017; VIONIS/PAPANTONIOU 2019.

³⁶ ISM I 378 = SEG XIX 476; PETCULESCU 2006.

concentric zones of production. The radius of the central zone is 2 km, while the distances between other zones range from 20 to 30 km. The theorized zones, moving outward from the market centre, include horticulture and other perishable goods, followed by forested areas, three different arable systems, and finally, ranching.⁴¹

According to von Thünen, every product has a cost-distance function, meaning that profitability varies depending on the distance from the market. The intensity of cultivation decreases as one moves away from the city.⁴² Therefore, perishable crops such as fruits and vegetables, whose profitability declines rapidly with distance, would be grown close to urban centres. In contrast, land farther away would be used for activities that involve more durable products, such as forestry, arable farming, and livestock.

According to Central Place Theory, formulated by W. Christaller, every good has both a minimum and a maximum range. He defined the maximum range as “the farthest distance the dispersed population is willing to travel in order to buy a good offered at a place”.⁴³ The minimum range is “the minimum amount of consumption of this central good needed to pay for its production or offering”.⁴⁴

In this framework, how can these theories be applied to the rural territories of Istros and Tomis? To determine the exact distance from the centre and analyse the economic character of the settlements, we conducted a buffer analysis to delineate the radii around the city. The 10 km buffer represents a two-hour walk, while the 20 km radius corresponds to a four-hour walk (Fig. 5A). The first buffer zone defines the agricultural radius, representing the maximum area that farmers living in the central area could cultivate daily. The second catchment area encompasses the maximum region where surplus agricultural produce could be sold through the market. A 20 km distance marks the maximum range a farmer would be willing to walk to sell surplus goods and obtain items unavailable locally. Traveling farther would increase expenses due to additional costs for accommodation and safekeeping of goods.

Based on this analysis, we identify two categories of settlements: agricultural settlements and mini-markets (fairs).⁴⁵ In region Istros, the map indicates only 10 settlements within the 10 km buffer and 20 sites within the 20 km buffer. In contrast, in the chora of Tomis, approximately 35 sites are located within 10 km of the urban centre, while around 30 settlements fall within the 20 km buffer (Fig. 5A). Several factors may explain these settlement patterns. In the territory of Istros, most settlements located 20 km or more from the town are situated on high-quality soil, near other resources such as stone, iron, and copper (Fig. 5B), or close to roads. This suggests that periodic markets may have existed near roads, ensuring the trade of agricultural products. In the territory of Tomis, settlements located approximately 20 km from the urban centre are found in areas with chernozem soils or near roads and vici. This indicates that small

markets may have been established not only along roads but also within vici (Fig. 5B).

It is worth noting that in Mandragoreis, a village in the territory of Magnesia-on-the-Maeander, temporary markets were attested as early as 10 km from the urban centre.⁴⁶ While this cannot be considered a general rule, this case demonstrates that proximity to the centre does not always determine the existence of temporary markets.

DISCUSSION

All known ancient markets were situated at a considerable distance from towns, with the nearest urban centres typically more than 15 km away, and in some cases as far as 25 or 30 km.⁴⁷ Notably, no rural market has been identified within 10 km of an urban centre.⁴⁸

In this framework, analysis indicates that the vast majority of Roman rural sites in the hinterlands of Istros and Tomis are located within 20 km of the urban centre. Only a few scattered sites lie beyond this range, with the farthest at approximately 40 km. This suggests that immediate proximity to urban centres was not a decisive factor for Roman farmers. The relatively low number of sites within a 5 km radius of urban centres could be attributed to several factors. First, both towns were Greek foundations with strong traditions of external sea trade dating back to the Classical and Hellenistic periods. This tradition likely persisted into the Roman era. The Roman colonization of the rural hinterland began at a distance of at least 10 km from the town, primarily driven by soil fertility and favourable agricultural prospects. Therefore, the vici in both hinterlands, as well as some villae (notably in the hinterland of Istros) served as focal points for settlement development in their proximity. Second, soil fertility played a significant role in settlement distribution. Additionally, access to resources such as stone, iron, and copper was a key factor in some cases. Finally, proximity to roads was a crucial determinant in the location of settlements more than 10 km from urban centres. This factor, combined with closeness to vici and villae, suggests the presence of minor or temporary markets along roads and within vici. Small-scale trade within villae cannot be ruled out either.

Settlements within a 10 km radius of urban centres likely supplied towns with goods related to small-scale industry. However, information about temporary or periodic markets remains scarce. These markets are documented in Italy (Latium and Campania) during the 1st century AD and in Africa and the province of Asia in the 2nd–3rd centuries AD.⁴⁹ These included weekly markets, such as the *nundinae*, and lower-frequency fairs. J. Andreau, A. Storchi Marino, and A. Ziccardi observed the development of a regional network between the cities of Latium and Campania.⁵⁰ Ziccardi concluded that major market centres maintained a linear structure following a dendritic model, while minor markets

⁴¹ PARR 2015, 2017.

⁴² VON THÜNEN 1842, 92–102; PARR 2015.

⁴³ CHRISTALLER 1966; PARR 2017.

⁴⁴ CHRISTALLER 1966; PARR 2017.

⁴⁵ DONEV 2019.

⁴⁶ DE LIGT 1993; PONT 2009, 203.

⁴⁷ DE LIGT, 1993; TEMIN 2013.

⁴⁸ DE LIGT, 1993; TEMIN 2013.

⁴⁹ ANDREAU 2000, 2021; CAMODECA 1999; STORCHI MARINO 2000; ZICCARDI 2000.

⁵⁰ ANDREAU 2000, 2021; STORCHI MARINO 2000; ZICCARDI 2000.

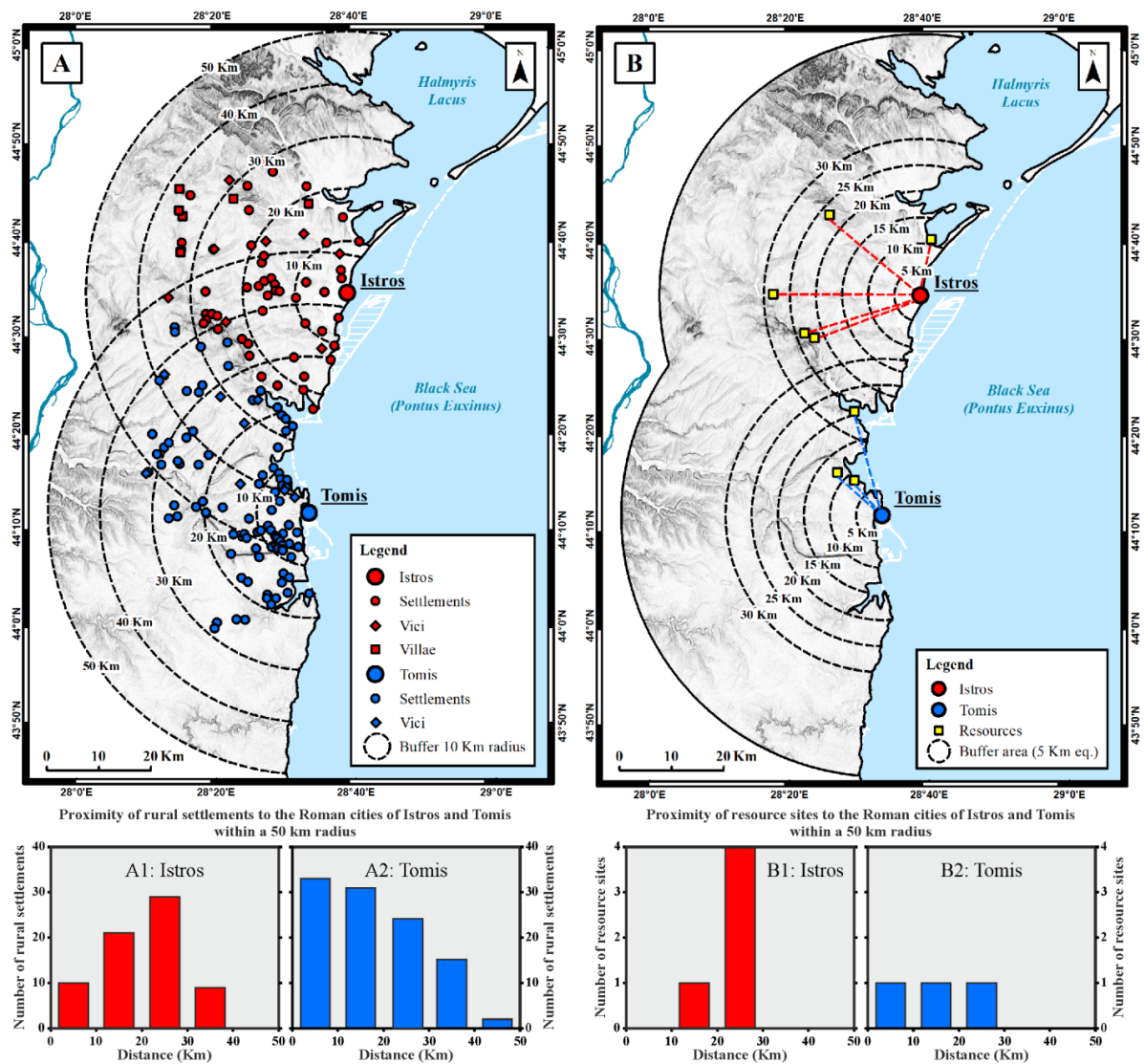


Fig. 5. Proximity of (A) rural settlements and (B) resource sites to the Roman cities of Istros and Tomis, within a 50 km radius on land around the cities

along main routes were organized according to the Central Place model.⁵¹

Markets in 1st-century Italy differed significantly from those in *Moesia Inferior*. First, the traded products varied between Istros, Tomis, and other regions such as Italy,⁵² Greece,⁵³ Africa, and Asia. For example, olive oil production in Africa stimulated the amphorae industry.⁵⁴ In Italy, horticultural products were transported from rural areas to town markets,⁵⁵ and a similar, albeit smaller-scale, pattern may have existed in Istros and Tomis. Grains and, occasionally, cattle were likely traded at fairs, as suggested by evidence from Argamum, where animal husbandry and hunting are well attested through osteological remains.⁵⁶ However, the range of other traded goods, such as pottery, metal tools, and small objects, remains unclear.

Fish was certainly a significant commodity, as it had been

since the Greek period. The inhabitants of Istros retained the right to fish without paying a fee.⁵⁷ As expected, a large quantity of ancient fish remains has been found at Argamum⁵⁸. However, systematic studies of fish remains in other settlements within the territories of Istros and Tomis are lacking. Meat consumption, including both domestic animals and game, is evident at Argamum,⁵⁹ but archaeozoological investigations have not yet provided sufficient insights into livestock practices across these rural areas.

The maximum distance between military fortifications in the region was 30 km, with roads controlled by *beneficarii*.⁶⁰ Some villae in *Moesia Inferior* engaged in trade with the military, and similar interactions may have occurred in the territory of Istros, where many villae were owned by veterans. In the northern Roman Empire, army supply from villae is well documented through *negotiatores frumentarii*⁶¹ and *nautae*,⁶²

⁵¹ ZICCARDI 2000.

⁵² MARZANO 2013.

⁵³ RIZAKIS 2013.

⁵⁴ AHMED 2019.

⁵⁵ Pliny, Nat. hist. 18.13; WITCHER 2016.

⁵⁶ MALAXA 2024.

⁵⁷ ISM I, 68.

⁵⁸ DUMITRACHE, 2023; MALAXA, 2023; HONCU *et alii* 2024.

⁵⁹ MALAXA 2024.

⁶⁰ MIHAILESCU-BÎRLIBA, 2021; MIHAILESCU-BÎRLIBA/ODOCHICIUC *in print*.

⁶¹ CIL XIII 8725.

⁶² CIL XIII 8815.

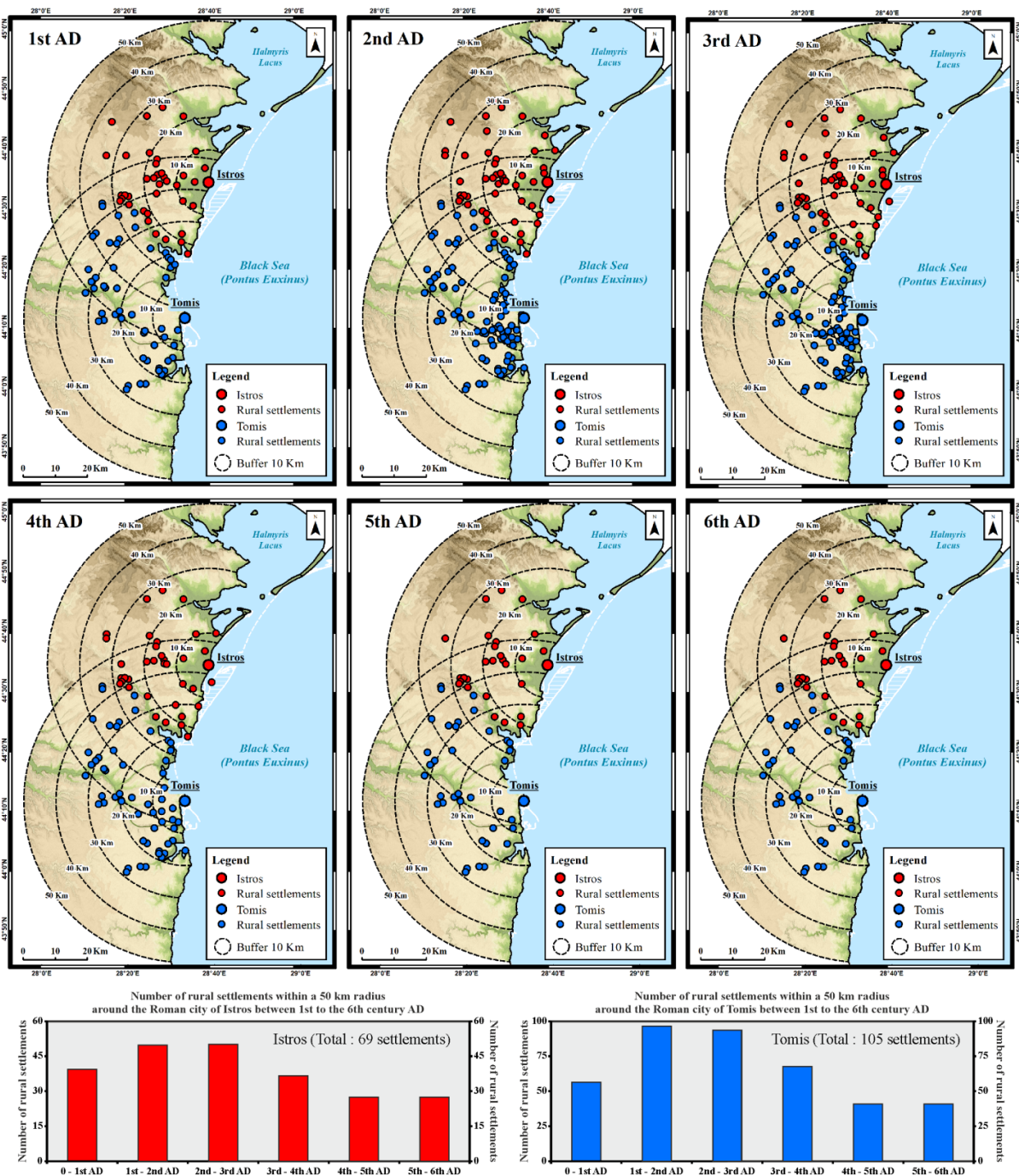


Fig. 6. The rural settlements associated with the Roman cities of Istros and Tomis on the reconstructed western coastline of the Black Sea (Pontus Euxinus) and their evolution over time from the 1st to the 6th century AD.

as well as through archaeological findings.⁶³ Analysing the distances between villae (e.g., Casimcea, Nistorești, and Sarighiol de Deal), military fortifications along the Danube, and Istros, it becomes evident that they were spaced at approximately 30 km intervals, a distance manageable in a day's travel by horse or ox-cart. This underscores their economic potential and engagement in trade.

In the Roman Empire, the rural settlements and villae provided production, storage, livestock, surpluses, and trade.⁶⁴

⁶³ HABERMEHL 2013.

⁶⁴ HABERMEHL 2011, 2013, 142, 148; TAYLOR 2011, 187–191; RIZAKIS 2013, 39–40; BLÖCK 2019, 13–22; FERDIÈRE 2019, 81–92; GROOT 2016, 145–149; MARTIN 2019, 33–37; COLOMINAS/GALLEGO-VALLE 2022; SÁNCHEZ-SIMÓN 2022, 222–223.

Further evidence of rural settlements' involvement in military trade comes from villae specializing in wine production. Though not found in the immediate territories of Istros and Tomis, similar villae have been discovered near Roman legionary forts at Novae, Niculițel, and Troesmis.⁶⁵ The security provided by the military and the economic opportunities associated with supplying the army likely contributed to the prosperity of settlements near these fortresses. A hoard from the Early Roman Empire discovered at Medgidia (in the territory of Tomis) suggests significant wealth accumulation by its owner.⁶⁶

⁶⁵ DYCZEK 2007.

⁶⁶ TALMAȚCHI/CUSTUREA 2011.

Emporia, such as the one founded by Septimius Severus at Pizos (south of Augusta Traiana in Thrace),⁶⁷ played a key role in rural trade.⁶⁸ Unlike the *nundinae* in Italy or Africa, these emporia were settled by *peregrini*, primarily of Thracian origin. As Boteva stated, these market centres supported the rural economy by serving remote villages while simultaneously stimulating commerce in the cities to which they were linked.⁶⁹ These emporia functioned more as permanent market centres than as periodic markets. De Ligt and Temin likened them to the rural fora of the western provinces.⁷⁰

During the Principate, the state occasionally took the initiative in founding emporia, whereas temporary markets arose independently of state intervention. In Istros and Tomis, periodic markets seem more probable. Two arguments support this hypothesis: first, while settlements were generally located more than 10 km from cities, they were often near roads and military installations;⁷¹ second, epigraphic evidence for periodic markets in the Empire is sparse, and Moesia Inferior is no exception. As a concluding remark in this respect, we think that the criteria used by L. de Ligt to define the fairs (the limited duration, the small catchment area – a maximal radius of 50 km, the low volumes of exchanged goods, the prevalence of direct sales to final consumers)⁷² can partially be applied to our space. We keep some reserves on the frequency and on the quantity of exchanged goods, taking into account the contacts with the Roman army the supplying needs of Roman soldiers. We can use like another argument for the existence of periodic markets in Istros could an inscription mentioning the complete restoration (*a fundamentis*) of the *macellum* by Gordian III.⁷³ This could indicate that the *macellum* did not function any more, but we have to stay prudent regarding the formula *vetustate conlapsum* like generic one and not mandatory like expressing the reality.

Locational analysis reveals that Roman rural sites clustered around resources much like they do today. The primary factor influencing settlement location was accessibility, particularly proximity to transportation routes. Roman farmers prioritized logistical advantages and arable land quality over immediate proximity to urban centres. This contrasts with von Thünen's model, which applies more closely to other Mediterranean regions, such as Patrai.⁷⁴ Additionally, small and periodic markets likely developed within *vici* and along roads, facilitating more efficient agricultural trade.

As the urban population grew, agricultural zones expanded to meet increasing demand.⁷⁵ This is evident in Tomis, a major city and provincial capital of *Moesia Inferior*. Over time, settlement patterns evolved: in the 1st century AD, Roman settlements were closer to urban centres, though many were already located beyond a 10 km radius. By the 2nd and 3rd centuries, their numbers increased significantly,

reflecting population growth, the influx of veterans and Roman citizens (*conventus*), and the colonization of Bessi and Lai groups (Fig. 6).

Ultimately, the distances recorded in the Roman period exceeded those proposed by von Thünen, indicating a trade system with strong local and internal characteristics. The growing settlement network led to the establishment of new 'minor markets' such as Fântânele and Tariverde near Istros and Cumpăna, near Tomis. While some markets developed along major roads, others were located in fertile agricultural areas.

6. CONCLUSIONS

Roman rural sites in Istros and Tomis were strategically located based on natural resources, agricultural potential, and proximity to essential infrastructure such as water sources and roads. Most settlements were situated on plains or gentle slopes (0–5% gradient), aligning with Roman agricultural practices.

Soil quality played a crucial role in settlement choices, with the majority of sites found on fertile chernozem soils. The proximity of settlements to transport routes suggests a well-integrated economy in which agricultural surpluses were traded locally and with the military. Roads were a key factor in settlement distribution, with most sites positioned within 5 km of major communication routes. Temporary and periodic markets likely existed within *vici* and along roads, facilitating trade in agricultural products and possibly small-scale industries. Some *villae* also participated in trade with the Roman army, supplying food and goods. Access to water sources was another critical factor, with 70% of rural sites in Tomis and 45% in Istros located within 1 km of a river.

Early Roman settlements were concentrated closer to urban centres, but by the 2nd–3rd centuries AD, expansion led to settlements farther away, likely driven by population growth and increased demand for arable land. By the 3rd century, some marginal lands were cultivated, possibly due to soil depletion in previously settled areas. The Roman rural economy functioned through a network of *vici*, *villae*, and temporary markets, resembling models observed in other provinces. Trade was shaped by local needs, military demand, and urban consumption rather than large-scale external commerce. Unlike in Italy, rural markets in Istros and Tomis were typically located more than 10 km from urban centres. The expansion of settlements coincided with demographic growth, including the arrival of Roman veterans and colonists. Rising market demand from urban expansion also contributed to the extension of agricultural zones beyond traditional limits.

The settlement strategies in Istros and Tomis reflect a well-organized rural economy that prioritized accessibility, resource availability, and integration into trade networks. In some respects, this system diverged from classical economic models such as von Thünen's Isolated State Theory. Additionally, the role of periodic markets and military supply chains played a crucial part in sustaining the regional economy.

⁶⁷ IGB III, 1690.

⁶⁸ BOTEVA 2000, 2015.

⁶⁹ BOTEVA 2015.

⁷⁰ DE LIGT 1993; TEMIN 2013.

⁷¹ PANAITTE 2023.

⁷² DE LIGT 1993, 15.

⁷³ ISM I, 168; HORSTER 2001, 413; DAGUET-GAGEY 2012, 162; ODOCHICIUC 2016; CRISTILLI 2023.

⁷⁴ RIZAKIS 2013.

⁷⁵ WILSON 2009.

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ABBREVIATIONS

- CIL
Corpus Inscriptionum Latinarum, Berlin.
- IGB
Inscriptiones Graecae in Bulgaria repertae, Sofia.
- ISM
Inscriptiones Scythiae Minoris, Bucharest-Paris.
- RAN
Repertoriul Arheologic Național, Bucharest.
- SEG
Supplementum Epigraphicum Graecum, Amsterdam-Leiden.

REFERENCES

- AHMED 2019
Ahmed, M.A.M., *Rural settlement and economic activity: Olive oil, wine and amphorae production on the Tarhuna Plateau during the Roman period* (London: The Society for Libyan Studies).
- ALEXANDRESCU/SCHULLER 1990
Alexandrescu, P./Schuller, W. (eds.), *Eine Griechenstadt an der rumänischen Schwarzmeerküste* (Konstanz: Xenia. Konstanzer Althistorische Vorträge und Forschungen).
- ANDREAU 2000
Andreau, J., Les marchés hebdomadaires du Latium et de Campanie au Ier siècle ap. J.-C. In: Lo Cascio, E. (ed.), *Mercati permanenti e mercati periodici nel mondo romano. Atti degli Incontri capresi di storia dell'economia antica* (Bari: Edi Puglia), 69–91.
- ANDREAU 2021
Andreau, J., *Économie de la Rome antique. Histoire et historiographie* (Bordeaux: Ausonius).
- ANGELESCU 2005
Angelescu, M.V., Histria. Sistemul de duble incinte din epoca greacă, *Studii și Cercetări de Istorie Veche și Arheologie* 54–56, 55–84.
- ANGELESCU 2019
Angelescu, M.V., *Histria. Cent campagnes archéologiques* (Saarbrücken: Éditions Universitaires Européennes).
- AVRAM 1990
Avram, A., Das histrianische Territorium in griechisch-römischer Zeit. In: Alexandrescu, P./Schuller, W. (eds.), *Histria. Eine Griechenstadt an der rumänischen Schwarzmeerküste* (Konstanz: Xenia. Konstanzer Althistorische Vorträge und Forschungen), 9–43.
- BĂRBULESCU 2001
Bărbulescu, M., *Viața rurală în Dobrogea romană (sec. I–III p. Chr.)* (Constanța: Muzeul de Istorie Națională și Arheologie Constanța).
- BĂLTĂC 2011
Băltăc, A., *Lumea rurală în provinciile Moesia Inferior și Thracia (secolele I–III p. Chr.)* (Bucharest: Renaissance).
- BOUNEGRU et alii 2009
Bounegru, O./Romanescu, Gh./Alexianu, M./Dumitrache, I./Vasiliniuc, I., Hinterland and Site Catchment Studies at Histria on the Black Sea Coast, Romania, *Antiquity Project Gallery* 83 (322). <https://www.antiquity.ac.uk/projgall/bounegru322>
- BÎRZESCU/RABINOWITZ 2021
Bîrzescu, I./Rabinowitz, A., The rock-cut inscriptions from Casian and their context, *Dacia Nouvelle Série* 65, 127–150.
- BLÖCK 2019
Blöck, L., A Model for Calculating the Capacities of horrea and Agricultural Areas of Gallo-Roman villae in the province of Germania superior. In: Martin, St. (ed.), *Rural Granaries in Northern Gaul (Sixth Century BCE–Fourth Century CE). From Archaeology to Economic History* (Leiden/Boston: Brill), 13–22. doi:10.1163/9789004389045_003
- BOTEVA 2000
Boteva, D., Another evidence for the establishment of Pizos?, *Thracia* 13, 21–25.
- BOTEVA 2015
Boteva, D., Roman Emperors Visiting the Danubian Province of Lower Moesia. In: Zerbini, L. (ed.), *Roma e le province del Danubio. Atti del I Convegno Internazionale Ferrara-Cento, 15–17 Ottobre 2009* (Soveria Mannelli: Rubbettino), 231–248.
- CAMODECA 1999
Camodeca, G., *Tabulae pompeianae Sulpiciorum (TPSulp.)*: edizione critica dell'archivio puteolano dei Sulpicii (Rome: Quasar).
- CHASE et alii 2011
Chase, A. F./Chase D./Z., Weishampel J./E./ Drake J.B./Shrestha R. L./Clint Slatton K./Awe J. J./Carter W. E., Airborne LiDAR, archaeology, and the ancient Maya landscape at Caracol, Belize, *Journal of Archaeological Science* 38(2), 387–398.
- CHRISTALLER 1966
Christaller, W., *Central Places in Southern Germany*, transl. by C. W. Baskin (Englewood Cliffs: Prentice Hall-Inc.).
- COLOMINAS / GALLEGO-VALLE 2022
Colominas, L./Gallego-Valle, A., Investigating Livestock Practices in the Countryside of Roman Spain: An Archaeozoological Approach. In: Bermejo Tirado, J./Grau Mira, I. (eds.), *The Archaeology of Peasantry in Roman Spain* (Berlin-Boston: De Gruyter), 71–88. <https://doi.org/10.1515/9783110757415-005>
- CONNOLLY/LAKE 2006
Connolly, J., Lake, M., *Geographical Information Systems in Archaeology* (Cambridge: Cambridge University Press).
- CRISTILLI 2023
Cristilli, A., Algunas precisiones sobre los macella romanos y la función del pórtico de sus fachadas, *Spal* 32(2), 209–228. <https://dx.doi.org/10.12795/spal.2023.i32.17>
- DAGUET-GAGEY 2012
Daguet-Gagey, A., Édiles et marchés dans l'occident romain extra italo-africain. In: Capdetrey, L., Hasenohr, C. (eds.), *Agoranomes et édiles. Institutions des marchés antiques* (Bordeaux: Ausonius), 155–173.
- DAMIAN, P./Georgescu, L. 2019
Damian, P./Georgescu, L., Predictive Modeling and GIS in the Archaeology of Tomis, *Journal of Black Sea Studies*, 15(3), 145–162.
- DE LIGT 1993
De Ligt, L., *Fairs and Markets in the Roman Empire. Economic and Social Aspects of Periodic Trade in a Pre-Industrial Society* (Amsterdam: J. C. Gieben).
- DINCAUZE 2000
Dincauze, D. F., *Environmental Archaeology: Principles and Practice* (Cambridge: Cambridge University Press).
- DONEV 2019
Donev, D., *The Busy Periphery: Urban Systems of the Balkan and Danube Provinces (2nd – 3rd c. AD)* (Oxford: Archaeopress).
- DUMITRACHE 2023
Dumitrache, I., Fishing in the Black Sea basin in ancient times. Technological, economic and social approaches.

- In: Nuțu, G./Ailincăi, S.-C./Țârlea, A./Ștefan, E. (eds.), *HERIPRENEURSHIP. Sustainable Tourism, Heritage Management and the Cultural and Creative Industries: Creating New Investment Opportunities at Places of Cultural Significance, Proceedings of the Tulcea International Conference, Tulcea, June 8th–9th 2023* (Cluj-Napoca: Mega), 329–337.
- DYCZEK 2007
Dyczek, P., Wine in Lower Moesia, *Historia Antiqua* 15, 237–250.
- ERDKAMP 2001
Erdkamp, P., Beyond the Limits of the ‘Consumer’ City. A Model of Urban and Rural Economy in the Roman World, *Historia* 50(3), 332–356.
- FERDIÈRE 2019
Ferdrière, A., De nouveaux formes de stockage des céréales à l’époque romaine en Gaule: quels changements, avec quell(s) moteur(s)? In: Martin, St. (ed.), *Rural Granaries in Northern Gaul (Sixth Century BCE-Fourth Century CE). From Archaeology to Economic History* (Leiden/Boston: Brill), 73–105. doi:10.1163/9789004389045_007
- FRAYN 1993
Fraysn, J. M., *Markets and Fairs in Roman Italy. Their Social and Economic Importance from the second century BC to the third century AD* (Oxford: Clarendon Press).
- GAFFNEY/STANČIČ 1991
Gaffney, V./Stančič, Z., *GIS Approaches to Regional Analysis: A Case Study of the Island of Hvar* (Ljubljana: Ljubljana University Press).
- GOODCHILD 2007
Goodchild, H., *Modelling Roman agricultural production in the Middle Tiber valley, Central Italy* (Birmingham: The University of Birmingham). <https://etheses.bham.ac.uk/id/eprint/175/1/Goodchild07PhD.pdf>.
- GOODCHILD 2013
Goodchild, H., GIS Models of Roman Agricultural Production. In: Bowman, A., Wilson, A. (eds.), *The Roman Agricultural Economy. Organization, Investment, and Production* (Oxford: Oxford Studies on the Roman Economy 3, Oxford University Press), 55–83.
- GRAU MIRA 2022
Grau Mira, M., A Peasant Landscape in the Eastern Roman Spain. An Archaeological Approach to Territorial Organization and Economic Models. In: Bermejo Tirado, J./Grau Mira, I. (eds.), *The Archaeology of Peasantry in Roman Spain* (Berlin/Boston: De Gruyter), 91–109. <https://doi.org/10.1515/9783110757415-06>
- GROOT 2016
Groot, M., *Livestock for sale: Animal Husbandry in a Roman Frontier Zone. The Case Study of the Civitas Batavorum* (Amsterdam: Amsterdam University Press).
- HABERMEHL 2011
Harbermehl, D., Exploring villa development in the northern provinces of the Roman empire. In: Roymans, N./Derks, T. (eds.), *Villa Landscapes in the Norman North. Economy, Culture and Lifestyles* (Amsterdam: Amsterdam University Press), 61–82.
- HABERMEHL 2013
Harbermehl, D., *Settling in a Changing World. Villa Development in the Northern Provinces of the Roman Empire* (Amsterdam: Amsterdam University Press).
- HONCU et alii 2024
Honcu, Șt./Cornea, A.-M./Chirilă I.-A./Chiriloaie, B., Argamum-Sector Poarta Mică. In: *Cronica cercetărilor arheologice din România. Campania 2023* (Târgu Mureș: Institutul Național al Patrimoniului/Muzeul Județean Mureș), 233–234.
- HORSTER 2001
Horster, M., *Bauinschriften römischer Kaiser. Untersuchungen zu Inschriftenpraxis und Bautätigkeit in Städten des westlichen Imperium Romanum in der Zeit des Prinzipats* (Stuttgart: Franz Steiner).
- HOWEY 2007
Howey, M. C. L., Using multi-criteria cost surface analysis to explore past regional landscapes, *Journal of Archaeological Science*, 34(8), 1198–1208.
- JENESON 2011
Jeneson, K., Evaluating settlement patterns and settlement densities in the villa landscapes between Tongres and Cologne. In: Roymans, N./Derks, T. (eds.), *Villa Landscapes in the Norman North. Economy, Culture and Lifestyles* (Amsterdam: Amsterdam University Press), 259–273.
- KYAMME 1999
Kvamme, K. L., Recent directions and developments in geographical information systems, *Journal of Archaeological Research* 7(2), 153–201.
- LIXĂNDRESCU et alii 2022
Lixăndrescu, Gh./Ovrei A.-B./Caloian, A. S., Analysis of the functional territorial structure of Constanța Municipality (Romania), using GIS techniques, *Cinq Continents* 12 (25), 89–107.
- LLOBERA 2003
Llobera, M. 2003, Extending GIS-based visual analysis: The concept of visualscapes. *International Journal of Geographical Information Science* 17(1), 25–48.
- MALAXA 2023
Malaxa, D., The Study of Fish Remains from the Late Roman Era from Argamum, Tulcea County, *Studia Antiqua et Archaeologica* 29(2), 347–356. DOI: 10.47743/saa-2023-29-2-9
- MALAXA 2024
Malaxa, D., Identificarea resurselor animale provenite din nivelul de epocă romană târzie de la Argamum, Sectorul Poarta Mică. Rezultate preliminare. In: *Cronica cercetărilor arheologice din România. Campania 2023* (Târgu Mureș: Institutul Național al Patrimoniului/Muzeul Județean Mureș), 235–236.
- MARTIN 2019
Martin, St., Calculating the Storage Capacities of Granaries: A Tentative Model. In: Martin, St. (ed.), *Rural Granaries in Northern Gaul (Sixth Century BCE-Fourth Century CE). From Archaeology to Economic History* (Leiden/Boston: Brill), 33–47. doi:10.1163/9789004389045_005
- MARZANO 2013
Marzano, A., Le villae rusticate romane e loro dimensione economica: uno sguardo alla penisola italiana. In: Rizakis, A. D., Touratsoglou, I. P. (eds.), *Villae rusticae: family and market-oriented farms in Greece under the Roman rule. Proceedings of an international congress held at Patrai, 23–24 April 2010* (Athens: National Hellenic Research Foundation/Institute of Historical Research-De Boccard), 6–19.
- MATEI-POPESCU 2013
Matei-Popescu, F., Statutul juridic și teritoriul Histriei in epoca romană. In: Panait Birzescu, F., Birzescu, I., Matei-Popescu, F., Robu, A. (eds.), *Poleis în Marea Neagră. Relații inerpontice și producții locale / Poleis in the Black Sea Area. Interpontic Relations and Local Productions* (Bucharest: Humanitas), 203–232.
- MATTHEWS 2018
Matthews, S.R., *The Logistics of Feeding the Roman Army on the Lower Danube* (London: University of London, PhD thesis).
- MIHAILESCU-BÎRLIBA 2016
Mihailescu-Bîrliba, L., Les Bessi à Ibida, *Analele Științifice ale Universității „Alexandru Ioan Cuza” din Iași. Istorie* 62, 13–16.

- MIHAILESCU-BÎRLIBA 2018
Mihailescu-Bîrliba, L., *Rure vivere in Moesia inferior. La population dans le milieu rural d'une province périphérique de l'Empire romain* (Wiesbaden: Harrassowitz).
- MIHAILESCU-BÎRLIBA 2021
Mihailescu-Bîrliba, L., Les bénéficiaires des gouverneurs et les stations douanières en Mésie Inférieure. In: Mihailescu-Bîrliba, L./Dumitrache, I. (eds.), *Persevera lucere. Studia in memoriam Octaviani Bounegru* (Wiesbaden: Harrassowitz), 35–50.
- MIHAILESCU-BÎRLIBA/ODOCHICIUC IN PRINT
Mihailescu-Bîrliba, L., Odochiciuc, A., The roads and the beneficiarii in Moesia Inferior. In: Tapavicki-Ilić, M./Bogdanović, I. (eds.), *Proceedings of the Sixth International Conference on Roman Danubian Provinces* (Belgrade: Institute of Archaeology).
- NEGULA et alii 2020
Negula I. D./Moise C./Lazăr A. M./Ris N. C./Cristescu C./Dedulescu A. L./Mihalache C. E./Badea A., Satellite Remote Sensing for the Analysis of the Micia and Germisara Archaeological Sites, *Remote Sensing* 12, doi.org/10.3390/rs12122003
- ODOCHICIUC 2016
Odochiciuc, A., Considération sur le macellum d'Histria, *Studia Antiqua et Archaeologica* 22(2), 195–201.
- PANAITE 2014
Panaite, A., Histria- A Greek City in a Roman Province, *Pontica* 47, Suppl. 3, 43–67.
- PANAITE 2023
Panaite, A. 2023. Roads and the Roman Landscape in Moesia Inferior. In: Hanscam, E./ Karavas, J. (eds.), *The Roman Lower Danube Frontier. Innovations in Theory and Practice* (Oxford: Archaeopress), 63–88.
- PARR 2015
Parr, J. B., 2015. Exploring the urban system of von Thünen isolated state, *Papers in Regional Science* 94 (1), 161–176.
- PARR 2017
Parr, J. B., Central place Theory: An Evaluation, *Review of Urban & Regional Development Studies* 29, 3, 151–216. doi: 10.1111/rurd.12066
- PETCULESCU 2006
Petculescu, L., The Roman army as a factor of romanisation in the north-eastern part of Moesia Inferior. In: Bekker-Nielsen, T. (ed.), *Rome and the Black Sea region: domination, romanization, resistance* (Aarhus: Aarhus University Press), 31–42.
- PINTILIE/DUMITRACHE 2023
Mihu-Pintilie A./Dumitrache, I. 2023. Tracing fishing activity along the Western Black Sea coast through ancient literary sources. In: Gastescu, P./Bretcan, P. (eds.), *Water resources and wetlands, 6th International Hybrid Conference Water resources and wetlands* (Valahia University of Târgoviște), 152–163
- PONT 2009
Pont, A.V. Rituels civiques (apantèsis et acclamations) en Asie Mineure à l'époque romaine. In: Hekstra, O./Schmidt-Hoffner, S./Witschel, Chr. (eds.), *Ritual Dynamics and Religious Change in the Roman Empire. Proceedings of the Eighth Workshop of the International Network Impact of the Empire* (Heidelberg, July 5–7, 2007) (Leiden/Boston: Brill), 185–211.
- POPESCU/RUSU 2018
Popescu, D./Rusu, I. Viewshed Analysis and Defensive Strategies in Ancient Tomis, *Archaeological Review of the Black Sea*, 12(4), 210–225.
- PRICE 1993
Price, T. D., The West Pontic 'Maritime Interaction Sphere': A Long-Term Structure in Balkan Prehistory? *Oxford Journal of Archaeology*, 12(3), 245–256.
- RIZAKIS 2013
Rizakis, A. D., Rural structures and agrarian strategies in Greece under the Roman Empire. In: Rizakis, A. D./Touratsoglou, I. P. (eds.), *Villae rusticae: family and market-oriented farms in Greece under the Roman rule. Proceedings of an international congress held at Patrai, 23–24 April 2010* (Athens: National Hellenic Research Foundation/Institute of Historical Research-De Boccard), 20–51.
- SÁNCHEZ-SIMÓN 2022
Sánchez-Simón, M., Villae and Farms: Early Imperial Rural Settlement in the Adaja-Eresma Basin (Central Roman Spain). In: Bermejo Tirado, J./Grau Mira, I. (eds.), *The Archaeology of Peasantry in Roman Spain* (Berlin-Boston: De Gruyter), 201–227. https://doi.org/10.1515/9783110757415-010
- STORCHI MARINO 2000
Storchi Marino, A., Reti interregionali integrate e circuiti di mercato periodico negli indices nundinari del Lazio e della Campania. In: Lo Cascio, E. (ed.), *Mercati perenni e mercati periodici nel mondo romano. Atti degli Incontri capresi di storia dell'economia antica* (Bari: Edi Puglia), 93–130.
- STREINU 2017
Streinu, A. 2017. Early Roman finds from Acic Suat (Caraburun, Baia, Tulcea County), *Peuce Serie Nouă* 15, 279–294.
- SUCEVEANU 1998
Suceveanu, A., *Fântânele: contribuții la studiul vieții rurale în Dobrogea romană* (Bucharest: Editura Academiei Române).
- SUCEVEANU/ANGELESCU 2004
Suceveanu, A., Angelescu, M., *Histria's New Look – A 3D Model* (Bucharest: CIMEC).
- TALMAȚCHI/CUSTUREA 2011
Talmațchi, G., Custurea, G., *Repertoriul tezaurilor monetare din Dobrogea* (Constanța: Muzeul de Istorie Națională și Arheologie Constanța).
- TAYLOR 2011
Taylor, J., The idea of the villa. Reassessing villa development in south-east Britain. In: Roymans, N./Derks, T. (eds.), *Villa Landscapes in the Norman North. Economy, Culture and Lifestyles* (Amsterdam: Amsterdam University Press), 179–194.
- TEMIN 2013
Temin, P., *The Roman Market Economy* (Princeton/Oxford: Princeton University Press).
- VIONIS/PAPANTONIOU 2019
Vionis, A. K./Papantoniou, G., Central Place Theory Reloaded and Revised: Political Economy and Landscape Dynamics in the *Longue Durée*, *Land* 8(2). https://www.mdpi.com/2073-445X/8/2/36
- VON THÜNEN 1842
von Thünen, J. H., *Der isolirte Staat in Beziehung auf Landwirtschaft und Nationalökonomie* part one (Rostock: Leopold).
- VON THÜNEN 1863
von Thünen, J. H., *Der isolirte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, part two and three (Rostock: Leopold).
- WILSON 2009
Wilson, A., Villas, horticulture and irrigation infrastructure in the Tiber Valley. In: Coarelli, F., Patterson, H. (eds.) *Mercator Placidissimus. The Tiber Valley in Antiquity New research in the upper and middle river valley* (Rome: Quasar), 731–768.
- WITCHER 2016
Witcher, R. E., Agricultural production in Roman Italy. In: Cooley, A. (ed.) *A companion to Roman Italy* (Chichester: Wiley-Blackwell), 459–482.
- ZICCARDI 2000
Ziccardi, A., Il ruolo dei circuiti dei mercati periodici nell'ambito

del sistema di scambio dell'Italia romana. In: Lo Cascio, E. (ed.), *Mercati perenni e mercati periodici nel mondo romano. Atti degli Incontri capresi di storia dell'economia antica* (Bari: Edi Puglia), 131-148.

ZIMMERMANN 2021

Zimmermann, K., *Funde und Befunde aus Histria. Aufsatzsammlung zur Archäologie der westpontischen Metropole* (Rahden: Verlag Marie Leidorf).