

## Ancient toilets – a cultural and social history

### Introduction

Toilets are the real treasure troves for researchers of the past. As the authors of the book, *Rubbish – the Archaeology of Garbage*, state, “garbage is among humanity’s most prodigious physical legacies to those who have yet to be born” (Rathje and Murphy 2001, 4). Waste accumulated in latrines can shed light on ancient lifestyles in a way other contexts are not able to. The architectural and archaeological features of ancient Greek and Roman toilets have been investigated to some extent in the past decades, but there is no in-depth historical study available on ancient sanitation. Additionally, the studies into the material culture of Greek and Roman toilets are based on heavily biased assumptions about the function and smells of ancient latrines. As explained in detail below, most of the scholarship on ancient sanitation maintains the belief that Graeco-Roman cities were malodorous due to their reliance on cesspits instead of sewers. The current consensus relies on modern (Western) preferences for sewage by over-emphasizing its role in removing waste from private dwellings. However, the preference for modern sewage systems over historical practices reflects our own values rather than accurately representing those of the past. Additionally, previous scholarship asserts that (human) waste was omnipresent in ancient cities, as people defecated outside and emptied chamber pots in the city streets. Unfortunately, there is no actual evidence to corroborate the dramatic narrative of waste accumulating in the city streets, but these statements are based on generalizations of rather few, superficially interpreted literary passages. Revisiting these assumptions is essential for offering a deeper understanding of historical urban environments and the everyday experiences of the inhabitants of these cities.

Hence, our project will investigate toilets and their role in waste management and sanitation in the ancient Greek and Roman world, from a new perspective, for a holistic comprehension of the sanitation practices of Graeco-Roman antiquity. As such, it will be the first comprehensive historical study of Greek and Roman toilet culture.

### State of the art: Greek and Roman houses, toilets and their stinks

The project draws inspiration from a larger framework of sensory scholarship, that has emerged in recent years as an important movement within the studies of the past (see, e.g. Bradley 2015 on ancient olfaction). As the tenet of sensory studies states, smelling and other senses, are not only physiological phenomena but also cultural and historical ones, and without understanding the ancient sensory landscape and its cultural, historical, and social aspects, our knowledge of the past inevitably remains limited (for the theoretical background, see Classen et al. 1994, Day 2013). Before the *sensory turn*, which aims at understanding ancient space from a multisensory point of view, giving emphasis not only on vision but other sensations too, the research of ancient housing witnessed another research trend, the so-called *spatial turn*. In the study of Campanian sites of Pompeii and Herculaneum, as well as in the research into Greek domestic space, this emerged during the late 1980s and 1990s, when pioneering researchers established a foundation for understanding space predominantly through its visual aspects. This entailed a detailed examination of sightlines, visual pathways within homes, and the role of decorative elements such as wall paintings and mosaics in shaping and defining these spaces. Additionally, scholars explored the intricate connections between social activities within these dwellings, their practical functions, the embellishments adorning them, and their architectural designs. Ancient homes were essentially viewed as portals into the social fabric, where the arrangement of spaces and decorative designs conveyed a language that directed the movement of the household members and visitors (e.g. Wallace-Hadrill 1994; Clarke 1991; Laurence 1994; Laurence and Wallace-Hadrill 1997; Nevett 1999). Space is, however, not configured only by sight. Olfaction plays an important, yet overlooked, part in the design and experience of lived space. **This project aims to remedy this oversight in the studies of ancient housing, focusing on the sensescapes produced by the latrines and associated waste management.**

The study of ancient toilets has concentrated on the latrines of the Roman world, while our knowledge of Greek toilets is less comprehensive, although general outlines of the development are known (e.g. Antoniou, 2007). The history of the Greek toilets dates back to the Minoans, who already had sophisticated drainage and sewerage systems in Crete (Yannopoulos et. al. 2017, Antoniou & Angelakis 2015). The Myceneans shared similar technologies, but without running water in their toilets. From the 6th until the 1st century BC the system developed, and in the Classical and Hellenistic towns, stormwater and human wastes were delivered to a collection basin outside of towns (De Feo et al. 2014). According to Antoniou (2007), the typical mature ancient Greek lavatory was probably formed in the Hellenistic period, which was a period of a great evolution of the ancient Greek water technology. More advanced public and private baths and toilets were also developed during the same periods. As Yannopoulos et. al (2017) state, “the Romans subsequently applied these earlier techniques to larger constructions for a greater number of users at one time---. In addition, due to their improved aqueduct technology they could provide continuously flowing water to most public toilets. Also, the scale of sewerage and drainage systems was highly increased.” The island of Delos serves as an illustrative example of this development. Delos was a major cult center from 900 BCE to 100 CE. Aside from a pilgrimage hub, it was a major trading port with a number of large and wealthy homes. Latrines dating back to Hellenistic and Roman periods have been found both from the private houses and from the proximity of temples and other public buildings (Antoniou 2007).

The study of Roman latrines, on the other hand, has concentrated on the external features of archaeologically attested facilities. For the most part, these studies overlook the historical and linguistic evidence of ancient toilet use. Ancient Roman toilets received some degree of attention in the early research of Pompeii, most importantly in H. Mygind's work in the early 1900s. The study of Roman (and Pompeian) toilets took properly off only several decades after Mygind's input. The mid1980s work by A. Scobie on Rome's sanitation practices paints an appalling picture of a city where open cesspits emitted irritating odors, and streets were used for defecation, echoing L. Mumford's earlier depiction of Roman sewage system as “absurdly spotty and inefficient”. Mumford's view, in turn, was based heavily on R. Lanciani's writings on Roman waste management (Mumford 1979, 252-4; Lanciani 1898). Lanciani's findings (which do not include toilets) have been widely utilized as the source of Roman urbanism and the odorscapes of Rome, but recently his accounts of foul-smelling archaeological findings have been criticized as sensational exaggeration (e.g., Emmerson 2020, 96–106, Morley 2015, 112).

A lot of the previous Roman latrine research culminates in the book *Roman Toilets: their Archaeology and Cultural History* (Jansen et al. 2011. For other studies, see, Hobson 2009ab; Koloski-Ostrow 2015b; Trusler and Hobson 2017), in which articles from pioneering scholars on Roman sanitation and toilets, including G. Jansen, A. O. Koloski-Ostrow, G. Thüry, and A. Wilson outline the form and function of Roman toilets in the city of Rome itself and in the Roman provinces, mainly using archaeological evidence. The book offers a wealth of information but comes short in many areas, especially regarding the aspects of odors the toilets (presumably) produced. In addition, the book does not offer an in-depth analysis of the cultural history of toilets and their users (see also Jansen et al. 2024 for iterating the same attitudes). Some literature has been used as a source material, but it has dealt with rather superficially. Additionally, previous scholarship asserts that heaps of rubbish, in which dogs and rats feasted and (human) waste were omnipresent in Roman cities as people used streets for excreting feces and dumping chamber pots and other waste. For instance, in a chapter of the book *Rome, Pollution and Propriety: Dirt, Disease and Hygiene in the Eternal City from Antiquity to Modernity* (Bradley and Stow 2012), P. Davies claims that the Roman streets probably were covered with excrement, leftover food, dead bodies, and dung (Davies 2012). A. Koloski-Ostrow also holds the view that the thoroughfares of Rome likely featured a mixture of manure, vomit, urine, and fecal matter (Koloski-Ostrow 2015a; see also Classen et al. 1994, 17, Scobie 1986, 410, 421, Jansen 2011, 131, Aldrete 2014, 51–52; Aldrete 2018, 374; Havlíček and Morcinek 2016).

Unfortunately, such arguments are based on unsupported assumptions, as there is no actual evidence to corroborate the dramatic narrative of excrement accumulating in the city streets, but these statements are based on generalizations of very few, superficially interpreted literary passages, as Nissin has criticized in a recent article (Nissin 2022). Furthermore, such arguments often include (sometimes subconsciously) a contrast between a filthy past and a clean and deodorized present, even though many modern cities in the seemingly

clean Western countries are losing the battle against rubbish, which ends up polluting the oceans and other vulnerable ecosystems.

In a similar way, studies that have discussed the sensory experiences of other historical cities, often depict premodern urban spaces as horribly malodorous due to factors like fetid industries, garbage accumulation, and unsanitary practices (e.g., Classen et al. 1994). However, detailed research into historical waste management practices has challenged such views recently. For instance, R. van Oosten's research on historical Dutch cesspits shows how the "Great Stink" in the Dutch city of Leiden in the 17th century is a feature of an early modern rather than a premodern city, not caused by cesspit latrines but by a sewage system that used canals for dumping waste (van Oosten 2016). Similarly, D. Jørgensen questions the assumptions of the inefficacy of sanitation in Medieval Europe, stating that, contrary to popular belief, in medieval cities, waste did not accumulate on streets, as inhabitants of the cities were actively maintaining street cleanliness (Jørgensen 2008, 566).

Such attitudes have found their way into general history and popular writings of (past) defecation and toilets, which often offer a very misleading picture of Roman ways of relieving oneself (e.g. Illich 2004, 355–56, Reinartz 2014, 179. See also Henshaw 2014, Laporte 2000, Furrer 2004). **Therefore, revisiting these assumptions is essential for offering a proper understanding of historical urban environments and the everyday experiences of the inhabitants of these cities.**

The current consensus found in the previous research relies on modern (Western) preferences for sewage by over-emphasizing its role in removing waste from private dwellings. However, the preference for modern sewage systems over historical practices reflects our own values rather than accurately representing those of the past (cf. Jansen 2018, Nissin 2022). The "flush and forget mentality" of modern sanitation is in many ways problematic, and especially detrimental to ecosystems. Additionally, according to WHO, 1.5 billion people are still in the 21st century lacking safely arranged sanitation and millions of people excrete in the open ([www.who.int/news-room/factsheets/detail/sanitation](http://www.who.int/news-room/factsheets/detail/sanitation)). Furthermore, land degradation, which is a continuously growing problem, is partly caused by the intensiveness of modern agriculture and not by premodern farming practices where manure (including "humanure") was used as fertilizer. Therefore, the juxtaposition of the "sanitary" and "healthy" modern world and the "squalid" and "unhealthy" past does not bear closer scrutiny and the discussion revolving around sanitary practices—past and present—needs to be readjusted accordingly. **This research sets out to do just that, in an all-encompassing cultural and sociohistorical analysis of sanitation practices of antiquity**

### **Material, methods and research questions**

The project will undertake a source critical textual analysis of ancient Greek and Roman literature and epigraphy investigating the aspects of uses and users of latrines in the association of smellscapes, and other sensory aspects of sanitation, waste management, and socio-spatial and architectural aspects discussed in the texts. The research also asks what kind of values and attitudes the ancient Mediterraneans associated with toilets and ordure, and how (human) waste was managed in the domestic and urban areas and agriculture. Additionally, the uses of ordure in medicine and magic are investigated.

Literary evidence consists of a wide range of ancient literature. Greek literature discussed in the study extends from mainly from Classical to Roman periods. Plays, especially Old Comedy of Aristophanes and Cratinus, represent the Classical period, but aside from comedy, the philosophers also discussed e.g. the smells in the Greek poleis (e.g. Aristotle, *On the Soul*). Poetry, especially epigrams from the Hellenistic period onwards, share the comical approach to the issue, but all genres of fiction are scrutinized in the study. In addition to this, medical texts are discussed (Hippocrates, Galen), and magical documents such as magical papyri (*Papyri Graecae Magicae*) are consulted. Both the magical papyri and other religious texts, such as inscribed cult regulations, also shed light on the issue of ritual purity, and how it relates to the everyday life of the residents in the urban centers.

Late Republican and (early) Imperial works are in the majority of Latin literature used, but the overall time frame is wide, ranging from Plautus (3rd/2<sup>nd</sup> century BC) to Digest of Justinian (compiled in the 6th Century AD), allowing an in-depth exploration of sanitation and sensory encounters in urban and domestic contexts. In addition, Latin epigraphical material (available in *Corpus Inscriptionum Latinarum Open Access*) will be used. This will permit a systematic, source-critical text analysis of a wide range of texts, instead of just concentrating on very few passages as has been done previously. Most important passages are further examined using close reading. The research will be carried out at the University of Helsinki, which can provide necessary resources, most importantly the library services.

Based on preliminary observations of the research material we plan to focus on the following aspects

- *The olfactory landscape of ancient sanitation*

A textual analysis of sanitary practices discussed in the ancient texts, focusing on the olfactory aspects of urban and domestic space. In classical studies, the analysis of how domestic and urban spaces were arranged has traditionally focused on sight and visual elements. Understanding the ways smells shape spaces and architecture will have a bearing on the further understanding of city planning, how urban and domestic space was understood, and what kind of spaces and constructions were considered salubrious, and unhealthy. We know that the Roman classification of healthy/unhealthy relied on organoleptic assessment. But how such attitudes are displayed in the context of architecture and housing? By identifying the differences in the olfactory landscape of the city block, we can infer how the social hierarchies of space were formed and managed in the ancient societies. In her article from 2022, Nissin argues that Pompeian toilets were not as malodorous as previously thought (Nissin 2022). This idea needs to be now investigated further, using extensive evidence from other areas of the Graeco-Roman world.

- *Socio-spatial aspects of latrines*

Closely linked to the previous section but with a special emphasis on the spatial aspects of latrines, their construction, architecture, and material features in both written evidence and architectural material. This part will include a spatial analysis of the locations of (chosen) toilets in Pompeii and Herculaneum, and Delos as our Greek example. This will be accompanied by a study of inscriptions from the case study towns. The research touches on questions of ancient social classes and the ways different classes coexisted in the built-up urban quarters.

- *Uses and users of the latrines*

A socio-historical investigation, complementing previous sections, into the use of Greek and Roman domestic space, especially regarding the societal hierarchies (including class distinctions, gender roles, and slavery) in waste management and toilet use practices. Inequality is a key societal practice in dealing with refuse: as Sommer points out “getting another person to remove refuse is an option wherever inequality is present” (Sommer 2017, 74). Servile cleaning duties in latrines are discussed in the ancient literature, allowing an analysis of the social relationships within the domestic space. This particular facet will also use epigraphical material. In this area, we investigate the health and hygiene aspects related to latrines and waste management.

- *Purity and pollution: the moral implications of ordure*

The concepts of waste are culture-specific, even though there are certain cross-cultural or even universal aspects in the notions of dirt and disgust. This part of the research will discuss the Douglassian conceptions of the role of dirt and sanitation in the Greek and Roman mindset (Douglas 1966). This section will even delve into the mythological and religious texts regarding the cleanliness and purity of the ancient world and/or the lack thereof. Throughout the Graeco-Roman past, ritual purity (see e.g. Carbon & Peels-Matthey 2018, Chaniotis 2012) was an essential part of the worship of the gods. Early cult and ritual emphasized physical purity, but later on, spiritual purity became important as well. What is meant by ritual purity hence varied, but basic cleansing remained essential. On the other hand, we know that Greek “official” medicine made therapeutic use of e.g. excrement and urine (Harris 2020). We modern people easily see certain dichotomy here, but is it due to our own assumptions? In this study, we discuss both the complex concept of purity and its aspects, and the

practical approach to excrement found in e.g. the medical texts like Galen. We also scrutinize the magical papyri (*Papyri Graecae Magicae*) and see if human excrement is used e.g. in the healing rituals.

- *Latrines, ordure, and waste management in poetry and plays*

This part of the research will (re)investigate the role of toilets, sanitation and waste management in selected plays and poetry. Greek Old Comedy, much of it which we know through Aristophanes, is renowned for its parodical references to prominent individuals of the society – individuals the audience knew well –, but also for sexual references and raunchy toilet humor. Farts and the “need to crap” are joked about e.g. in Birds and in Clouds, both by Aristophanes. But it seems these features are not his inventions – the combination of political satire and toilet humour can be found already in the plays of his predecessor Cratinus (e.g. Run-aways). There are examples of Greek epigrams as well. E.g. in an fourth century AD epigram, found in a latrine next to the Baths of Constantine in Ephesus, the writer hopes the guest will have a satisfying visit, which is expressed in a rather straightforward way:...”Take a full pleasure in shitting your brains out...” (Ephesos 2104 [= IEph 456.1]). Both Greek epigraphical collections (*Inscriptiones Graecae*) and anthologies of Greek epigrams (e.g. *Anthologia Graeca*) are consulted for more such references.

The archaic Roman plays (most importantly those of Plautus) also offer a wealth of information regarding Roman everyday living. On the other hand, the poems of much later writers Juvenal and Martial have been used almost exclusively as the sources of the stinks in Roman toilets, often in a misleading way (see criticism in Nissin 2022).

- *Legislation concerning latrines and waste management*

This section uses most importantly the late-antique compilation of Roman legal writings, Justinian’s Digest in search of Roman legal concepts concerning ordure, latrines and waste, and how these were managed. Additionally, other legal sources and epigraphical material (such as the so-called *Tabulae Heracleenses* or the *Lex Iulia Municipalis*) are used as well. The Greek material, however, comes from much earlier sources. Around 500 BCE the Athenians established a law that required garbage to be thrown away at least one mile away from the city walls. This was both for hygienic reasons, to avoid illnesses, and for aesthetic reasons, to keep the city beautiful. In 320 BCE, Athens passed a law forbidding residents from throwing waste into the streets.

- *Agricultural aspects of ordure*

This part focuses on ordure and dung as fertilizers, and waste management in Roman agricultural writers (most importantly Cato, Varro, Columella). Additionally, the Pliny the Elder’s *Naturalis Historia* will provide useful information on dung in agricultural practices

## **Expected research results**

The findings of the research will make an important contribution to the understanding of the everyday life, living, and social relations of ancient Mediterranean societies. The project will provide valuable new information on sanitation, health, hygiene, and past reflections on these matters. The broader goal is the comprehension of the ancient world on a more general level. As the theory on the relationship between culture, use of space, and architecture states, the way societies arrange lived space reveals the underlying values and structures of the societies in question (for the theoretical background, see, Lefebvre 1974/1991; Kent 1990; Sennett 1998). Hence finding out how living in built-up city blocks was arranged and how these arrangements were sensed will elucidate the social relationships of ancient society and will lead to a better understanding of how cultural norms, use of space, environment, and physiological necessities influence each other.

Beyond academic goals, the results can be employed for the benefit of contemporary societies. As sanitation relying on water closets and sewage is not environmentally sustainable and/or readily available globally, the ideas and understanding of ancient practices of dry toilets in urban areas can help build accessible, sustainable toilets around the world still today. Access to functioning toilets to ensure bowel movement is of utmost importance for human health. Nevertheless, even though toilets and defecation have been investigated in the past and present, there is still a stigma attached to the subject.

The research of ancient toilets, and the culture related to their use can impact modern thinking and improve the world, by offering different ways of dealing with waste and reworking such detrimental cultural

aspects that are still affecting modern thinking. The study aims to raise awareness of sanitation crises and land degradation and offer insight and knowledge from the past for rethinking the ways to improve sanitation and agricultural practices in modern societies. The research fits well within the UN Agenda 2030 for sustainable development, most importantly to Goal 6. ‘Ensuring the availability and sustainable management of water and sanitation for all’. Additionally, it touches the Horizon Europe’s mission theme of Soil Health and Food and Kone Foundation focus area of Environmental sustainability. The proposed study has thus direct, international implications for evidence-based decision-making in public health and the benefits are apparent.

The project will engage in the current discussion around the topic in both academic and public events. Both researchers of the project are strongly committed to giving back to society, and especially eager to create dialogue and collaboration with the surrounding society by discussing our research also in non-academic platforms, which can reach wide audiences, e.g. by publishing articles intended for the general public, organizing outreach events, and communicating with the audience via traditional and social media. Both researchers also have a long experience in communicating their research to wider audiences, as indicated in the attached CV:s.

## **The team**

The team consists of two experienced researchers, who will be responsible for their own areas of research. Dr. Laura Nissin will work with the Latin literature and epigraphy and will also execute the literature review of previous archaeological research. She holds the title of Docent in Latin language and Roman literature and has vast experience in research into ancient cultural history and archaeology of the Roman world. Dr. Saara Kauppinen will work with the Greek material, mainly literature and epigraphy. She will also assist on selecting and reviewing the archaeological research of the Greek sanitation and lavatories. She has a PhD in Greek language and literature, and is specialized in Greek epigraphy, but also has vast experience of both Greek and Latin literature, social history, and material aspects of the Graeco-Roman world, including Greek archaeology. The work will also consist of jointly written sections, in addition to the methods and results chapter, also a comparative analysis of the similarities and differences in the Greek and Roman toilet cultures.

## **Work plan and schedule**

The main research tasks are the analysis of ancient Greek and Roman literature and relevant epigraphical texts. The implementation of the research is rather straightforward; two researchers are needed at this stage. Nissin will be responsible for carrying out the analysis of Roman material and Kauppinen will work with the Greek literature. The first stage of the project lasts three years in all. The manuscript of the main output of the project, a monograph entitled *Ancient toilets – a cultural history*, is expected to be ready by the end of the three-year period

## **References**

Aldrete, G. S. 2014. “Urban sensations: Opulence and ordure.” In *A Cultural History of the Senses in Antiquity*, edited by J. Toner, 45–68. London and New York: Bloomsbury Publishing.

Antoniou, A. & Angelakis, A. N., 2015 “Wastewater and stormwater sanitation technologies in ancient Hellas”. In: *Sanitation, Latrines and Intestinal Parasites in Past Populations* (P. D. Mitchell, ed): 41–68.

Antoniou, G. P. 2007. “Lavatories in Ancient Greece”, in *Water Supply* (2007) 7 (1): 155–164.

Aldrete, G. S. 2018. “Hazards of life in ancient Rome: Floods, fires, famines, footpads, filth, and fevers.” In *A Companion to the City of Rome*, edited by C. Holleran and A. Claridge, 365–82. Hoboken, NJ: Wiley.

Bradley, M. and K. Stow. Eds. 2012 *Rome, Pollution and Propriety: Dirt, Disease and Hygiene in the Eternal City from Antiquity to Modernity*. 1st ed. Cambridge: Cambridge University Press.

Bradley, M. ed. 2015. *Smell and the Ancient Senses*. London and New York: Routledge.

Carbon, J.-M. and Peels-Matthey, S. (eds.): *Purity and Purification in the Ancient Greek World. Texts, Rituals, and Norms* (2018). Kernos supplements 32.

Chaniotis, A. : “Greek Ritual Purity: from Automatisms to Moral Distinctions” in P. Rösch and U. Simon (eds.), *How Purity is Made*, Weisbaden, Harrassowitz Verlag 2012, 123–139.

Clarke, J. 1991. *The Houses of Roman Italy 100 B.C.–A.D. 250: Ritual, Space, and Decoration*. Berkeley: University of California Press.

Classen, C., D. Howes, and A. Synott. 1994. *Aroma: The Cultural History of Smell*. London: Routledge.

Davies, P. 2012. "Pollution, propriety and urbanism in Republican Rome." In *Rome, Pollution and Propriety: Dirt, Disease and Hygiene in the Eternal City from Antiquity to Modernity*, edited by M. Bradley and K. Stow, 67–80.

Day, J., ed. 2013. *Making Senses of the Past: Toward a Sensory Archaeology*. Carbondale: Southern Illinois University Press.

De Feo, G., Antoniou, G., Fardin, H. F., El-Gohary, F., Zheng, X. Y., Reklaityte, I., Butler, D., Yannopoulos, S. & Angelakis, A. N. 2014: "History of sanitary sewers worldwide." In *Sustainability* 6, 3936–3974.

Douglas, M. 1966. *Purity and danger: an analysis of concepts of pollution and taboo*. London: Routledge.

Emmerson, A. 2020. *Life and Death in the Roman Suburb*. Oxford: Oxford University Press.

Furrer, D. 2004. *Wasserthron und Donnerbalken: Eine kleine Kulturgeschichte des stillen Örtchens*. Darmstadt: Primus-Verl.

Harris, W. V. 2020. "Scatological Asklepios: The Use of Excrement in Graeco-Roman Healthcare." In *Journal of the History of Medicine and Allied Sciences*, Volume 75, Issue 1, January 2020, 1–23.

Havlíček, F., and M. Morcinek. 2016. "Waste and pollution in the ancient Roman Empire." *Journal of Landscape Ecology* 9, no. 3: 33–49.

Henshaw, V. 2014. *Urban Smellscape: Understanding and Designing City Smell Environments*. London: Routledge.

Hobson, B. 2009a. *Pompeii, Latrines and Down Pipes: A General Discussion and Photographic Record of Toilet Facilities in Pompeii*. Oxford: Archaeopress.

Hobson, B. 2009b. *Latrinae et Foricae: Toilets in the Roman World*. London: Duckworth.

Illich, I. 2004. "The dirt of cities, the aura of cities, the smell of the dead, utopia of an odorless city." In *City Cultures Reader*, edited by M. Miles and T. Hall, with I. Borden, 355–59. London: Routledge.

Jansen, G. et al. 2011. *Roman Toilets: Their Archaeology and Cultural History*. Leuven: Peeters.

Jansen, G. 2011. "Roman toilets of the city of Minturnae. A preliminary report." In *Minturnae: nuovi contributi alla conoscenza della forma urbis: giornata di studio sui lavori a Minturnae*, edited by G. R. Bellini and H. von Hesberg, 129–38. Rome: Edizioni Quasar.

Jansen, G. 2018. "Sewers or cesspits? Modern assumptions and Roman preferences." In *Latrinae, Roman Toilets in the Northwestern Provinces of the Roman Empire*, ed. S. Hoss, 5–18. Oxford: Archaeopress.

Jansen, Gemma, et al. 2024 eds. *Sixty-Six Toilets and Urinals in the Ancient City of Rome: Sanitary, Urbanistic, and Social Agency*, Leuven; Paris; Bristol

Jørgensen, D. 2008. "Cooperative Sanitation: Managing Streets and Gutters in Late Medieval England and Scandinavia." *Technology and Culture*, 49(3), 547–567.

Kent, S. 1990. "Activity areas and architecture: An interdisciplinary view of the relationship between use of space and domestic built environments." In *Domestic Architecture and the Use of Space: An Interdisciplinary Cross-Cultural Study*, edited by S. Kent, 1–8. Cambridge: Cambridge University Press.

Koloski-Ostrow, A. O. 2015a. "Roman urban smells: The archaeological evidence." In *Smell and the Ancient Senses*, edited by M. Bradley, 90–109. London and New York: Routledge.

Koloski-Ostrow, A. O. 2015b. *The Archaeology of Sanitation in Roman Italy: Toilets, Sewers, and Water Systems*. Chapel Hill: University of North Carolina Press.

Lanciani, R. 1898. *Ancient Rome in the Light of Recent Discoveries*. Boston and New York: Houghton Mifflin.

Laporte, D. *History of Shit*. Cambridge, Mass.; MIT, 2000.

Laurence, R. 1994. *Roman Pompeii – Space and Society*. London and New York: Routledge.

Laurence, R., and A. Wallace-Hadrill, eds. 1997. *Domestic Space in the Roman World: Pompeii and Beyond*. Series Portsmouth: JRA.

Lefebvre, H. 1991. *The Production of Space (La production de l'espace)*. Translated by D. Nicholson-Smith. Oxford: Blackwell.

Morley, N. 2015. "Urban smells and Roman noses." In *Smell and the Ancient Senses*, edited by M. Bradley, 110–19. London and New York: Routledge.

Mumford, L. 1979. *The City in History: Its Origins, Its Transformations, and Its Prospects*. Reprint of 1961 ed. Harmondsworth: Penguin Books. Print.

Mygind, H. 1923. *Hygiejniske forhold i oldtidens Pompeji*. København: Koppels.

Nissin, L. 2022. "Smellscape of a Pompeian Neighborhood." *Journal of Roman Archaeology*.

Nevett, L. 1999. *House and Society in the Ancient Greek World*. Cambridge

Rathje, W. L., and Murphy, C. 2001. *Rubbish! The Archaeology of Garbage*. Tucson, AZ: University of Arizona Press.

Reinartz, J. 2014. *Past Scents: Historical Perspectives on Smell*. Urbana: University of Illinois Press.

Scobie, A. 1986. "Slums, sanitation, and mortality in the Roman world." *Klio* 68, no. 2: 399–433.

Sennett, R. 1998. *The Spaces of Democracy*. Ann Arbor, Mich: The University of Michigan, College of Architecture + Urban Planning, Print.

Sommer, U. 2017. "Salt, fire, cress and fennel – how to create pollution." *Journal of Neolithic Archaeology* 19: 61–96. DOI:10.12766/jna.2017.3.

Trusler, K., and B. Hobson. 2017. "Downpipes and upper story latrines in Pompeii." *JAS: Reports* 13: 652–65.

Wallace-Hadrill, A. 1994. *Houses and Society in Pompeii and Herculaneum*. Princeton: Princeton University Press.

van Oosten, R. 2016. "The Dutch Great Stink: The end of the cesspit era in the pre-industrial towns of Leiden and Haarlem." *EJA* 19, no. 4: 704–727.

Yannopoulos, S., Yapijakis, Ch., Kaiafa-Saropoulou, M., Antoniou G. P., 2017. "History of sanitation and hygiene technologies in the Hellenic world". In *Journal of Water, Sanitation and Hygiene for Development* 7 (2): 163–180.