

The Route to Crisis: Cities, Trade, and Epidemics of the Roman Empire

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The goal of this paper is to provide a universal model that outlines the origins of disease contraction and transmission in the ancient Mediterranean world. While numerous scholars have written on the subject of epidemics and their effects on the Roman Empire, very limited studies focus on the general causes of epidemics throughout the Roman era. I propose that Roman culture, urbanism, and the interdependence between cities and provinces led to the entry and transmission of communicable diseases, contributing to conditions that ultimately caused the fall of the empire. I first discuss and describe the causal factors of epidemics. I start by presenting Roman ideologies as this will aid in the understanding of city structure. After a description of a typical city layout, I present the conditions which encouraged the spread of disease within cities. Cities and provinces were not in isolation, but rather part of a greater economic network. I, therefore, also describe the nature of trade routes and how trade impacted the global spread of pathogens. I conclude by applying the proposed theories to two plagues—the Antonine Plague and Justinianic Plague—from different, yet comparable, time periods. I also gauge the effects of disease on Roman economy, demography, and society by using these case studies.

Commemorated for its far-reaching conquests, bustling cities, and luxurious public monuments, the Roman Empire is hardly associated with disease by the modern observer. In reality, the ancient Roman world teemed with infection and disease as evidenced by studies in archeology, anthropology, economics, and ecology. Galen, the renowned physician of the second century, unearths the blatant, gory truth about the city of Rome, “[the] populous city, where daily ten thousand people can be discovered suffering from jaundice, and ten thousand from dropsy.”¹ Epidemics were no different in their effect than jaundice and dropsy. Donald J. Hughes, supported by other scholars as William McNeill, proposes that the Justinianic Plague alone was the cause of death for half of the people living in the Mediterranean world in the sixth century.² Thus, the importance of acknowledging the presence of epidemics in the Roman Empire cannot be ignored.

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Most evidence presented here originates from modern archaeological and economic studies on the ancient world. I utilize virtual renditions of the city of Rome and trade routes to vividly illustrate the design of the empire. Whenever possible, I use direct literary recordings to enhance my argument. Such primary sources, however, are seldom and fail to provide a complete portrayal of ancient conditions. Scholars attempt to fill in gaps of history based on modern patterns. But inferences may be faulty, leaving us with limited knowledge of the past. I clearly note these limitations and shortcomings throughout this study.

¹ Quoted in Walter Scheidel, “Disease and Death in the Ancient City of Rome” (2009), 7.

² Donald J. Hughes, *Pan’s Travail* (The Johns Hopkins University Press: Baltimore, 1994), 182. See also William H. McNeill, *Plagues and Peoples* (Doubleday: New York, 1976), 124.

ROMAN URBANISM AND CITY CONDITIONS

In a general sense, a city is a congregation of people occupying a single space containing public architecture and monuments as well as private residences characteristic of the values and culture of the inhabitants. In the Roman sense, the city is a “symbol of prosperity and civilized culture”; a place for thought, reasoning, and sharing ideas; an elite storehouse of commodities, entertainment, and scholarship.³ The city, with its administration, structure, and culture garnered for the Romans, more specifically for the elite members of society, an identity and a “sense of place.” The city was not a mere conglomeration of citizens, but rather a set of opportunities which collectively created an “urban way of life” as Ray Laurence and associates term the phenomenon of Roman cities.⁴ Cities were nuclei for human survival and living.

Because of this reverence for the city, Roman and Byzantine emperors frequently endorsed the emergence of cities in new territories. Augustus (r. BC 27 – AD 14), the first emperor of Rome, asserts with pride, “I found Rome a city of bricks and left it a city of marble.”⁵ From its very start, the Roman Empire focused on building and fortifying cities. Augustus focused on expansion of the Roman Empire, annexing provinces including Egypt in the East and Dalmatia in the North. Cities in these provinces, such as Alexandria, were modified to fit Roman standards and to serve Roman political and economic functions.⁶ Even Hadrian (r. AD 117-138), who choose to avoid war, directed the empire’s resources to strengthening and Romanizing cities.⁷ The strong focus on cities was well preserved in the Byzantine era.⁸ Procopius, a historian for Emperor Justinian (r. 527 -565), praises a conquered land for their progress in forming a city:

[Justinian] conceived the desire to transform this place forthwith into a city which should be made strong by a wall and distinguished by other constructions as worthy to be counted a prosperous and impressive city; and the purpose of the emperor has been realized. For the wall and the city has been brought to completion, and the condition of the territory is being suddenly changed. The country dwellers have thrown aside the plough and lead the existence of a community, no longer going the round of country tasks but living a city life. They pass their days in the market place and hold assemblies to deliberate on questions which concern them; and they traffic with one another. And conduct all the other affairs which pertain to the dignity of the city.⁹

The city thus became the hallmark of the Roman world for centuries. And while each city preserved traces of its folk culture, cities of the empire shared several characteristics that encouraged the spread of disease.

The layout of cities was designed for close interaction reflecting the Roman ideologies of civilized culture. As Paul Erdkamp clearly delineates, “cities had to be built around public monuments” to encourage assemblies and councils.¹⁰ While the advancement of civilization was made possible by the city structure, the concentration of civilians in a single locus welcomed infection and disease. Bernard Frischer’s virtual rendition of the city of Rome illustrates the tight conglomerations of houses concentrated at the center of the city. According to his model, the radius of the heart of Rome was no more than ten kilometers, yet up to a million persons were considered citizens of Rome at the plateau of its power in the second century AD just before the Antonine Plague.¹¹ While it is true that only the main cities—such as Rome and Alexandria in the Roman Empire, Carthage in the Byzantine Empire—had populations above 100,000, land area generally correlated positively with population size. Furthermore, although the majority of citizens resided in the countryside, a great

3 Paul Erdkamp, “Urbanism,” *The Cambridge Companion to the Roman Economy*, edited by Walter Scheidel (Cambridge University Press: New York, 2012), 242.

4 Ray Laurence, Simon Esmonde Cleary, and Gareth Sears, *The City in the Roman West*, c. 250 BC-c. AD 250 (New York: Cambridge University Press, 2011), 4.

5 Suetonius, “Life of Augustus,” *The Lives of the Caesars*, translated by Alexander Thompson. In the Latin version, Augustus refers to himself in the third person: Marmoream se relinquere, quam latericium accepisset.

6 Sarolta A. Takács, “Alexandria in Rome,” *Harvard Studies in Classical Philology* (1995), 265. For more information regarding cities during the Augustan era, see Bertt Lott, *The Neighborhoods of Augustan Rome* (New York: Cambridge University Press, 2004).

7 Mary Boatwright, *Hadrian and the Cities of the Roman Empire* (Princeton: Princeton University Press, 2000), 12.

8 A deeper discussion of similarities and differences between the Roman and Byzantine era is beyond the scope of this paper. Major cities shared common characteristics. For more information, see Kenneth G. Holum, “The Classical City in the Sixth Century,” *The Cambridge Companion to the Age of Justinian*, edited by Michael Maas (Cambridge: Cambridge University Press, 2005), 87-112.

9 Procopius 6.6 quoted in Erdkamp, 241.

10 Erdkamp, 242.

11 Bernard Frischer, “Rome Reborn: A Digital Model of Ancient Rome,” Frischer Consulting, 18 November 2014, <http://romereborn.frischerconsulting.com/about-current.php>.

Distances estimated using Google Maps. Retrieved 17 November 2014.

My purpose in this section is to provide a holistic view of city layout. Many scholars have studied in great detail on the subject of Roman cities. For a more detailed explanation on city structure and daily life, see David Matz, *Daily Life of The Ancient Romans* (Westport: The Greenwood Press, 2002) as well as cited sources.

number of them traveled to nearby cities daily to conduct business and trade. Farmers of the hinterland would often leave their lands for easy labor jobs in the city and at least twenty percent of citizens permanently remained in the city.¹² Ultimately, high population density characteristic of Roman cities coupled with close interaction caused “unsanitary practices and infection” in both the city and the countryside.¹³ Cassius Dio records 2,000 deaths per day in Rome during a resurgence of the Antonine Plague. This number cannot be attributed to any other factor but high population density.¹⁴

Overpopulation and overcrowding caused other issues. Malnutrition was common among the urban poor and rural peasants causing an increased risk for disease contraction due to compromised health. The Roman diet for laborers consisted mainly of wheat, as opposed to the elite who feasted on fruits, vegetables, wine, cheeses, and even meat.¹⁵ Scheidel estimates that the caloric intake of Roman Egypt prior to the Antonine Plague could in no way be above a thousand calories.¹⁶ Approximately ninety-five percent of Roman citizens lived in poverty.¹⁷ In such conditions of scarce resources, the body focuses metabolism on survival over growth and height.¹⁸ An ongoing study by Geertje Klein-Goldewijk measures leg bone lengths from 10,000 skeletons from various locations in the Roman Empire. Using an enhanced formula to compare femur length with probable height, she found a common trend in decreased stature from the onset of the Roman age until the fourth century AD. Scheidel attributes this pattern to the “Malthusian scenario of diminishing wellbeing” because of the rise in population.¹⁹ Scheidel supports his case by referencing another study of over a thousand skeletons from seventy ancient sites in central Italy. This study, by Monica Giannecchini, concludes diminished stature compared to remains from both the Iron

Age and the Middle Ages.²⁰ Diminished immunity surely triggered infection in individuals, but sanitary conditions led to disease transmission on the scale of entire cities.

A common and prevalent problem in the city was the abundance of waste and sewage. No clear system existed for clearing waste causing citizens to throw their garbage in the nearest convenient ditch despite legislation prescribing punishment for such behavior. Julius Caesar, the last ruler of the Roman Republic, commanded street cleaning by every citizen.²¹ As we shall see in the case of the Justinianic Plague, foul street conditions invited pathogen-carrying vermin. In Rome, untreated sewage flowed through sewers into the Tiber River. Citizens disposed all kinds of rubbish into the river including “stale grain and bodies that had been denied burial.”²² Sanitary efforts contributed little to ameliorate the situation. Technological solutions seem to have improved the quality of life, but a closer observation reveals issues with the advancements. Aqueducts poured out into public basins and fountains which residents would pollute while obtaining large amounts of water at a time. Bacterial growth was not uncommon in the water lying stagnant in pottery that would be used for basic necessities.²³

While I only provide explanations on malnutrition and poor sanitation, other issues, including deforestation and pollution along with their consequences, contributed significantly to outbreaks. The provided examples, however, clearly delineate how overpopulation led to a demand for resources that nature could not provide, supporting pathogen growth and proliferation. Without doubt, city structure led to deleterious living conditions and the exacerbation of epidemics. Until now, I have focused on the city as a sole entity. Yet, cities functioned as “nodes of wider networks.”²⁴ The Roman Empire, in essence, was a highly interconnected web of cities and provinces, making possible the wide-scale transmission of contagion.

ROMAN DEMAND AND INTERDEPENDENCE

Cities enabled a division of labor. All types of trades and specialties were made possible by the gathering of peoples. In the sixth century, grave inscriptions

12 Erdkamp, 246.

13 Hughes, 162.

14 Scheidel, “Disease and Death in the Ancient City of Rome,” 7-8.

15 Geoffrey Kron, “Food production,” *The Cambridge Companion to the Roman Economy*, edited by Walter Scheidel. (Cambridge University Press: New York, 2012), 160.

16 Walter Scheidel, “A Model of Demographic and Economic Change in Roman Egypt After the Antonine Plague,” *Journal of Roman Archaeology* 15 (2002), 98.

17 Linda Giante, “Death and Disease in Ancient Rome.”

18 Walter Scheidel, “Physical Wellbeing in the Roman World,” (2010), 4-5.

19 Walter Scheidel, “Physical Wellbeing in the Roman World,” (2010), 5. See also, Geertje Klein Goldewijk, Johannes Petrus, and Antonius Maria Jacobs, *The Relation between Stature and Long Bone Length in the Roman Empire*. (University of Groningen, 2013).

20 Ibid, 5. See also, Monica Giannecchini and Jacopo Moggi-Cecchi, “Stature in Archeological Samples from Central Italy: Methodological Issues and Diachronic Changes,” *American Journal of Physical Anthropology* 135.3 (2008), 284-292.

21 Hughes, 162.

22 Ibid, 163. Hughes’ sources all come from ancient historians.

23 Scheidel, “Disease and death in city of Rome,” 9.

24 Robin Osborne and Andrew Wallace-Hadrill, “Cities of the Ancient Mediterranean,” *The Oxford Handbook of Cities in World History*, edited by Peter Clark (Oxford University Press: Oxford, 2013), 49.

included occupations from boot makers to butchers and carpenters to doctors.²⁵ Pliny the Elder states that before BC 171 there were no bread bakers in Rome, rather women in each household would make bread from wheat, which they often grew locally.²⁶ But, concerning Rome in his own day he states:

For who would not admit that, now that intercommunication has been established throughout the world by the majesty of the Roman Empire, life has been advanced by the interchange of commodities and by partnership in the blessings of peace, and that even things that had lain concealed have all now been established in general use.²⁷

Surely, trade advanced the power and scale of the Roman Empire. But this division increased interdependence between cities and provinces to supply each other with resources. In studying table and cooking-ware in Ostia, Michael Fulford found that a minimum of one-fifth of the sample size came in from other sites. This “considerable volume of maritime traffic” carried pathogens from region to region.²⁸

The high demand for trade in the Roman Empire initially stemmed from an imbalance of natural resources as cities arose and provinces were conquered. Resources were indeed diminished by large populations, but production in the countryside decreased substantially. Often, farming seasons yielded little crop due to climate changes.²⁹ This, coupled with a rise in demand, led Rome and surrounding cities to be beneficiaries of Sicily, Sardinia, and Africa (including Egypt) for wheat and corn foodstuffs. Josephus reports King Agrippa (d. AD 44), governor of Judea under Roman rule, as stating that “Egyptian corn fed the capital for four months alone” while the rest of North Africa for “eight months of the year.” This translates to an incredulous amount of 400,000 tons of grain imports to Rome in the first century AD. This represents 500 shipments each carrying at least 400 tons—near impossible in the ancient world. Fulford, agreeing with Peter Garnsey, is skeptical of such a large volume of transport, but agrees without doubt that “Africa was the single most

important source of Rome’s grain.³⁰

Trade toward the third and fourth centuries shifted more toward satisfying the desire for luxury and commodities in cities. Andrew Wilson cites recent archaeological work in Western India and Red Sea ports as evidence of a thriving and intensive trade between Roman Egypt, the Arabian Peninsula, and India. Egypt “exported gold, wine, and fish products, and imported spices, cotton textiles, pearls, and sea turtle shells” which it transported to the rest of the Mediterranean world.³¹ Commodities were available to all social levels, thus enabling the spread of disease from foreign lands to enter and infest the Roman world.³²

Resulting from the high demand for grain and commodities was a high interdependence between cities to provide each other essential and even extemporaneous resources. Figure 2, obtained from the ORBIS program, reveals the tight interconnections between more than three hundred cities. The path from Alexandria to Egypt takes twenty days in the warm seasons and a little over a month in the winter.³³ This time range is well within the life span of pests and rodents who often took advantage of wheat- and fruit-filled cargo ships to sail to new areas within the empire.

CASE STUDIES

The case studies presented below serve as models by which to understand how ancient urban structure and interdependence caused the entrance and widespread transmission of epidemics in the empire. A discussion on the impact of each plague will follow. The Antonine Plague struck the Roman Empire at the height of its glory during the second century AD, providing an exceptional model to observe the extent of damage brought about by an epidemic. The Justinianic Plague, although occurring in the Byzantine era, complements the Antonine Plague by providing a fuller illustration of disease transmission. The Byzantine age is marked by a time of considerable shift in politics and religion. The economic system and urban structure, however, remained largely unchanged from the previous centuries. The Justinianic Plague should therefore serve as a valid example for the factors aforementioned.

25 Erdkamp, 248.

26 *Natural History* 18.1070 quoted in Richard Duncan-Jones, *Structure and Scale in the Roman Economy* (Cambridge University Press: New York, 1990), 149.

27 *Natural History* 14.3 quoted in Kron, 157.

28 Michael Fulford, “Economic Interdependence among Urban Communities of the Roman Mediterranean,” *World Archeology* 19 (1987), 66.

29 Erdkamp, 255&261.

30 Fulford, 66-67.

31 Andrew Wilson, “A Forum on Trade,” *The Cambridge Companion to the Roman Economy*, edited by Walter Scheidel. (Cambridge University Press: New York, 2012), 290. Ports studied were those of Myos Hermos and Bernice.

32 Ibid, 288.

33 Walter Scheidel and Elijah Meeks, “ORBIS: The Stanford Geospatial Network Model of the Roman World,” 19 November 2014, <http://orbis.stanford.edu/>.

tioned.³⁴

The Antonine Plague and the Roman Economy

Entering in AD 165 and winding down in 180, the Antonine Plague took a hard toll on the estimated 60–70 million populace of the Roman Empire. The eye witness Galen explicitly records vomiting, fever, chills, headache, and a characteristic rash which led scholars to believe that the outbreak was smallpox.³⁵ How the virus entered the Roman Empire remains quite disputed. Duncan-Jones attributes Egypt as a probable entryway for the plague according to trade patterns with foreign regions.³⁶ A more accepted theory is that the virus attacked Rome by way of soldiers under the rule of Marcus Aurelius returning from war against the Parthians of Ham in Mesopotamia or from other battles in northeastern Italy.³⁷ By way of frequent trade traffic due to heavy dependence of Rome on Egypt for survival, the plague entered Alexandria and from there spread across the Mediterranean and the rest of the world. Duncan-Jones also supports the idea that the plague traveled as far as China in 166 either by the silk trade or from a political embassy.³⁸

The death toll, although once estimated to be 5 million, excluding provinces, cannot be accurately estimated given a lack of Roman archeological remains and tombs. Scheidel strongly argues against the use of model tables such as those made from the Egyptian census, dismissing them as incapable of representing the general trend of the region at large. Instead, Scheidel uses compelling economical evidence to demonstrate the effects of the Antonine more accurately.³⁹

Figure 3 is a graph compiled by Scheidel on Ancient Egyptian price and rent fluctuations presumably caused by the plague.⁴⁰ The AD 100-160 range is what Scheidel considers to be the pre-plague period, and 190-260 is termed post-plague. Scheidel argues that these values are determined by and directly reflect supply and

demand within Egypt, although wheat prices probably also reflected outside demand.⁴¹

His data are compelling. Generally, an increase in prices denotes an increase in demand, while a decrease represents lower demand. The price, and thus demand, for wine and oil, common commodities in the Roman world, decreased; oil less so probably due to its greater necessity. Wheat prices showed no change due to severe poverty, famine, and lack of other foodstuffs. Hughes attributes the 1.5 increase in donkey values to the diminished labor of farmers who were infected and eventually died. Roger Bagnall also suggests that villagers “simply went elsewhere, to villages where they were not registered and would...not face the same pressures.”⁴² Because of the decrease in population, land prices and rents for agricultural tools decreased between twenty-five to fifty percent. Resulting was a noticeable increase in monthly wages for farmers.⁴³ Considering the high population density of the ancient world prior to the plague and the referenced data, the plague actually helped to relieve some of the stress on the land and natural resources. Yet, since most villagers actually traveled elsewhere, the stress would have been placed on the resources of that area—something Scheidel neglects to consider. Scheidel does take caution in assuming that wellbeing was enhanced. Disagreeing with Willem Jongman and Geoffrey Kron, he states that archeologic and anthropologic evidence point to a low quality of life that did not improve after the plague. Nor would wellbeing have mattered in the face of a plague attacking a densely populated city.⁴⁴ Scheidel also admits that prices in Egypt “never returned to pre-plague levels” implying an increased labor on farmers and a decreased land yield.⁴⁵

Scheidel is adamant that “all factors moved in the predicted direction.” The rise in labor costs and decrease in prices of goods imply a considerable decrease in population. Skeptics of this model state that Scheidel often overlooks critical data such as the *P. Oxy. 66,4527* document on wheat taxes which suggest opposite trends at least for wheat—much less was transported to the capital for taxes.⁴⁶ This observation is supported by Fulford’s studies on trade patterns that suggest less of a dependence on

34 See footnote 8 for more information on the Byzantine Empire.

35 R.J Littman and M.L Littman, “Galen and the Antonine Plague,” *The American Journal of Philology* 94 (1973), 244-246.

36 R. P. Duncan-Jones, “The Impact of the Antonine plague,” *Journal of Roman Archaeology* 9 (1996), 110.

37 S. Sabbatani and Sirio Fiorino, “The Antonine Plague and the Decline of the Roman Empire,” *Le infezioni in medicina: rivista periodica di eziologia, epidemiologia, diagnostica, clinica e terapia delle patologie infettive* 17.4 (2009), 262.

38 Duncan-Jones, 136.

39 Walter Scheidel and John Sutherland, “Roman Wellbeing and the Economic Consequences of the ‘Antonine Plague,’” *Princeton/Stanford Working Papers in Classics*, (2010). <<https://www.princeton.edu/~pswpc/pdfs/scheidel/011001.pdf>>.

40 Scheidel standardized pre-plague values to 100 for easy and fair comparison.

41 Scheidel and Sutherland, 19.

42 Roger Bagnall, “P. Oxy 4527 and the Antonine Plague in Egypt: Death or Flight?,” *Journal of Roman Archaeology* 13 (2000), 291.

43 Scheidel, “A Model of Demographic and Economic Change in Roman Egypt after the Antonine Plague,” 107.

44 Scheidel and Sutherland, 13.

45 Scheidel, “A Model of Demographic and Economic Change in Roman Egypt after the Antonine Plague,” 104.

46 Roger S. Bagnall, “The effects of plague: model and evidence.” *Journal of Roman Archaeology* 15 (2002): 115.

Egypt for food after the plague.⁴⁷ Bagnall further critiques Scheidel by mentioning the fact that there was a sudden doubling of commodity prices in the late second century which Scheidel omits in his comparisons.⁴⁸ Scheidel claims that he took this into account by standardizing the prices, but there is no evidence suggesting he has done so in an objective, unbiased manner.

Despite these disagreements, the evidence presented by Scheidel and in part by Bagnall suggest a significant decline in population size in Roman Egypt during the second century, although less severe than the Black Death of the Middle Ages. In truth, “comparison with the sheer scale of post-plague changes in real wages in later periods of Egyptian history as well as in late medieval England... speaks against the notion that the Antonine Plague was a truly devastating crisis.”⁴⁹ Scheidel, however, makes the erroneous assumption that data from Egypt can be applied to the entire Roman Empire. For one, the city of Rome contained at least twice the amount of inhabitants than Alexandria. Egypt’s geography, culture, and division of labor were significantly different than any other province, let alone a city. Duncan-Jones offers compelling evidence from Roman inscriptions and records indicating that building construction was largely halted in the thirty years after the Antonine Plague. The opposite pattern occurs in Egypt during the same era.⁵⁰ Given Scheidel’s conclusions and Duncan-Jones’ literary evidence, it is actually compelling to assume that conditions in Rome were much more severe than Egypt, especially within the highly active army. Historians believe that the decrease in population and the lower quality of food availability eventually enabled the attack of Rome by barbarians, costing the empire the entire western region, leading to the Byzantine era.⁵¹

The Justinianic Plague, the plague of rodents

The Justinianic plague, accessing the empire by way of Egypt in the summer of AD 541, was the first of many outbreaks of the Bubonic Plague to have infected Europe. This infection is caused by contact with rodents carrying the bacteria *Yersinia pestis* and particularly through bites from fleas that previously bit infected rodents. Rats, and especially the black rat (*Rattus rattus*), have the inherent ability to store highly concentrated

bacteria in their bloodstream which is quickly transmitted to human populations upon which they depend for food and waste. Swelling and pain would ensue upon infection and often led to death in less than a week.⁵² Even after afflicting the empire for more than two centuries, the plague always reappeared in bursts until its final eruption in the Middle Ages, sweeping much of the European population. The death toll in the Byzantine era was no different.

The term for this plague, rightfully so, arose from the name of Emperor Justinian, who himself contracted the disease. Justinian was known for his attempts to reconquer the western part of the empire and to restore the luxurious days of the Roman city.⁵³ This promoted ideologies that necessitated the import of commodities from around the world, as discussed above. Historians attribute the demand for trade as an entry way for *Y. pestis* upon the unintentional introduction of the black rat. Black pepper was produced in India then transported across the Indian Ocean to the Red Sea Egyptian port of Quseir el Qadim as shown in Figure 4. From this port, the goods traveled across the Eastern Desert to ports on the Nile River from which they were conveyed downstream to Alexandria for shipment over the Mediterranean Sea.⁵⁴ Chromosomal and literary evidence indicate that *Rattus rattus*, entered the Roman world by way of Egypt, undoubtedly on board the ships carrying pepper. The rodent then rapidly spread throughout the empire by means of other trade routes, some which led as far North as Vindolanda in Britain.⁵⁵

Taking advantage of crowded urban conditions and unlimited food resources, the black rat species flourished in the empire.⁵⁶ Thus, tracing the movement of the rodents enables us to determine the rate and extent of the plague’s transmission. The rats themselves could travel no more than two-hundred meters in a lifetime, meaning only a few kilometers of natural migration per century.⁵⁷ This indicates that the spread of the rodents within cities and to other providences can be attributed mainly to human movement. About eighty percent of Roman rat finds, from archeological evidence of predator remains and furrows, occur near coasts or river banks. Rats commonly invaded ports to establish their colonies especially due to the rich resources of grain and corn found on cargo ships. Inland routes were also common travel routes for the rodents,

47 Fulford, 68.

48 Bagnall, 119.

49 Scheidel and Southerland, 23.

50 Duncan-Jones, 124-130.

51 For a detailed debate of this theory, see, J. Rufus Fears. “The Plague under Marcus Aurelius and the Decline and Fall of the Roman Empire.” *Infectious Disease Clinics of North America* 18 (2004), 65-77. and S. Sabbatani and Sirio Fiorino.

52 Michael McCormick, “Rats, Communications, and Plague: Toward an Ecological History”, *The Journal of Interdisciplinary History* 34 (2003), 2.

53 Erdkamp, 241.

54 Wilson, 290.

55 McCormick, 7.

56 Ibid, 16.

57 Ibid, 10.

who thereby infested the countryside. They preferred cart roads, common routes for grain, compared to lesser untrodden roadways.⁵⁸ Without doubt, the strong interconnection between regions of the Roman Empire exacerbated the spread of disease-causing vermin.

While trade and interconnection may explain the wide spread of the disease, negative human impact on the natural environment also contributed significantly to the severity of the plague. The clearing of forests for city expansion and human use caused the decline of several predators to the rats. Owls, foxes and weasels all were forced out from their natural habitat. The food chain was disrupted promoting increase in population sizes of *Rattus rattus*.⁵⁹ Hughes further argues that the direct impact of overpopulation engendered fluctuations in climate.⁶⁰ The direct human effect is somewhat debated by other scholars, but records certainly indicate cycles of heavy precipitation followed by drought occurring during the years of the Justinianic plague. During the heavy rain period, rodents would increase in population based on the increase in food resources and would then scatter abroad in search of resources in drought. Even in times of scarcity, cities provided rats with a wealth of waste tucked away in trenches in close proximity to houses and businesses.

⁶¹ These three examples attest to the detrimental effects of overpopulation and high demand.

Evidence is lacking to determine specific short term impacts of the plague, but is assumed to have afflicted the empire in a similar pattern as Antonine Plague. In his somewhat contested book entitled *Justinian's Flea*, William Rosen attributes the transition into the Middle Ages to the Justinianic plague:

The most long-lasting effect of the plague was not its initial impact, but the way in which its after-shocks remade the topography of Europe and the Mediterranean. As the demon washed across the lands once ruled by Rome, it left behind tidal pools: the distinctive regions in which proto-nations like the Franks, Lombards, Saxons, Slavs, and Goths could coalesce and combine into polities called France, Spain, and England.⁶²

Rosen may not be considering all aspects of the fall of the

Roman Empire, but he brings our attention to the importance of considering long term effects of plague. The decline and fall of the Roman Empire cannot be completely attributed to the frequency of plagues. Yet, scholars cannot deny the pivotal role disease played on weakening the mighty empire.

CONCLUDING THOUGHTS

All in all, this study attempts to provide a general paradigm for how epidemics were introduced and spread in the ancient world. Although the lack of evidence from the Roman Age forced scholars to make inferences in their research, modern epidemiological trends support the general framework of my argument. Many problems in history undoubtedly recur in the present. As such, this study begs the question, considering the current global interdependence, whether the present age would be able to withstand a pandemic. We have seen just how rapidly the H1N1 and Ebola viruses spread by way of transportation modes and close interactions within cities despite initial scientific and governmental efforts. An analysis of ancient epidemics may not provide direct solutions, but invites the modern society to consider its susceptibility to infection. As a united human race, we should not underestimate the dangers of epidemics and work in unison to prevent such catastrophes from occurring.

REFERENCES

- Bagnall, Roger S. "P. Oxy 4527 and the Antonine Plague in Egypt: Death or Flight?" *Journal of Roman Archeology* 13 (2000).
- , "The Effects of Plague: Model and Evidence." *Journal of Roman Archaeology* 15 (2002): 114-120.
- Boatwright, Mary. *Hadrian and the Cities of the Roman Empire*. Princeton: Princeton University Press, 2000.
- Duncan-Jones, Richard. *Structure and Scale in the Roman Economy*. New York: Cambridge University Press, 1990.
- , "The Impact of the Antonine Plague," *Journal of Roman Archaeology* 9 (1996): 108-36.
- Erdkamp, Paul. "Urbanism." *The Cambridge Companion to the Roman Economy* ed. Walter Scheidel, 241-265. New York: Cambridge University Press, 2012.
- Frisher, Bernard, "Rome Reborn: A Digital Model of Ancient Rome." *Frisher Consulting*. 18 November

⁵⁸ Ibid, 11&14.

⁵⁹ Ibid, 22.

⁶⁰ Hughes, 182-186.

⁶¹ McCormick, 16&20.

⁶² William Rosen, *Justinian's Flea* (New York: Penguin Group, 2007), Epilogue.

2014. <http://romereborn.frischerconsulting.com/about-current.php>.
- Fulford, Michael. "Economic Interdependence among Urban Communities of the Roman Mediterranean," *World Archeology* 19 (1987): 58-75.
- Gianecchini, Monica, and Jacopo Moggi-Cecchi. "Stature in Archeological Samples from Central Italy: Methodological Issues and Diachronic Changes." *American Journal of Physical Anthropology* 135.3 (2008): 284-292.
- Giante, Linda. "Death and Disease in Ancient Rome."
- Goldewijk, Geertje Klein, Johannes Petrus and Antonius Maria Jacobs. *The Relation Between Stature and Long Bone Length in the Roman Empire*. University of Groningen (2013)
- Holum, Kenneth G. "The Classical City in the Sixth Century", *The Cambridge Companion to the Age of Justinian* ed. Michael Maas, 87-112. Cambridge: Cambridge University Press, 2005.
- Hughes, Donald J. *Pan's Travail: Environmental Problems of the Ancient Greeks and Romans*. Baltimore: The Johns Hopkins University Press, 1994.
- Kron, Geoffrey. "Food Production." *The Cambridge Companion to the Roman Economy* ed. Walter Scheidel, 156-175. New York: Cambridge University Press, 2012.
- Laurence, Ray, Simon Esmonde Cleary, and Gareth Sears. *The City in the Roman West, c. 250 BC-c. AD 250*. New York: Cambridge University Press, 2011.
- Littman, R.J and M.L Littman. "Galen and the Antonine Plague," *The American Journal of Philology* 94 (1973): 243-255.
- Bertt Lott. *The Neighborhoods of Augustan Rome*. New York: Cambridge University Press, 2004.
- McCormick, Michael. "Rats, Communications, and Plague: Toward an Ecological History," *The Journal of Interdisciplinary History* 34 (2003): 1-25.
- McNeill, William H. *Plagues and Peoples*. New York: Double Day, 1976.
- Osborne, Robin and Andrew Wallace-Hadrill. "Cities of the Ancient Mediterranean." *The Oxford Handbook of Cities in World History* ed. Peter Clark. Oxford University Press: Oxford, 2013.
- Sabbatani, S. and Sirio Fiorino, "The Antonine Plague and the Decline of the Roman Empire," *Le infezioni in medicina: rivista periodica di eziologia, epidemiologia, diagnostica, clinica e terapia delle patologie infettive* 17.4 (2009), 260-283.
- Scheidel, Walter. "A Model of Demographic and Economic Change in Roman Egypt after the Antonine Plague." *Journal of Roman Archaeology* 15 (2002): 97-114.
- , "Disease and Death in the Ancient City of Rome." *Princeton/Stanford Working Papers in Classics*. 2009. <<https://www.princeton.edu/~pswpc/pdfs/scheidel/040901.pdf>> (15 November 2014).
- , "Physical Wellbeing in the Roman World." *Princeton/Stanford Working Papers in Classics*. 2010. <<https://www.princeton.edu/~pswpc/pdfs/scheidel/091001.pdf>> (15 November 2014).
- Scheidel, Walter and Elijah Meeks. "ORBIS: The Stanford Geospatial Network Model of the Roman World." 19 November 2014. <http://orbis.stanford.edu/>.
- Scheidel, Walter and John Sutherland. "Roman wellbeing and the economic consequences of the 'Antonine Plague'" *Princeton/Stanford Working Papers in Classics*. 2010. < <https://www.princeton.edu/~pswpc/pdfs/scheidel/011001.pdf>> (15 November 2014).
- Suetonius, "Life of Augustus," *The Lives of the Caesars*, translated by Alexander Thompson.
- Takács, Sarolta A. "Alexandria in Rome." *Harvard Studies in Classical Philology* (1995): 263-276.
- Wilson, Andrew. "A Forum on Trade." *The Cambridge Companion to the Roman Economy* ed. Walter Scheidel, 287-291. New York: Cambridge University Press, 2012.



Figure 1. Virtual Rendition of Rome. (Bernard Frisher, Rome Reborn.)

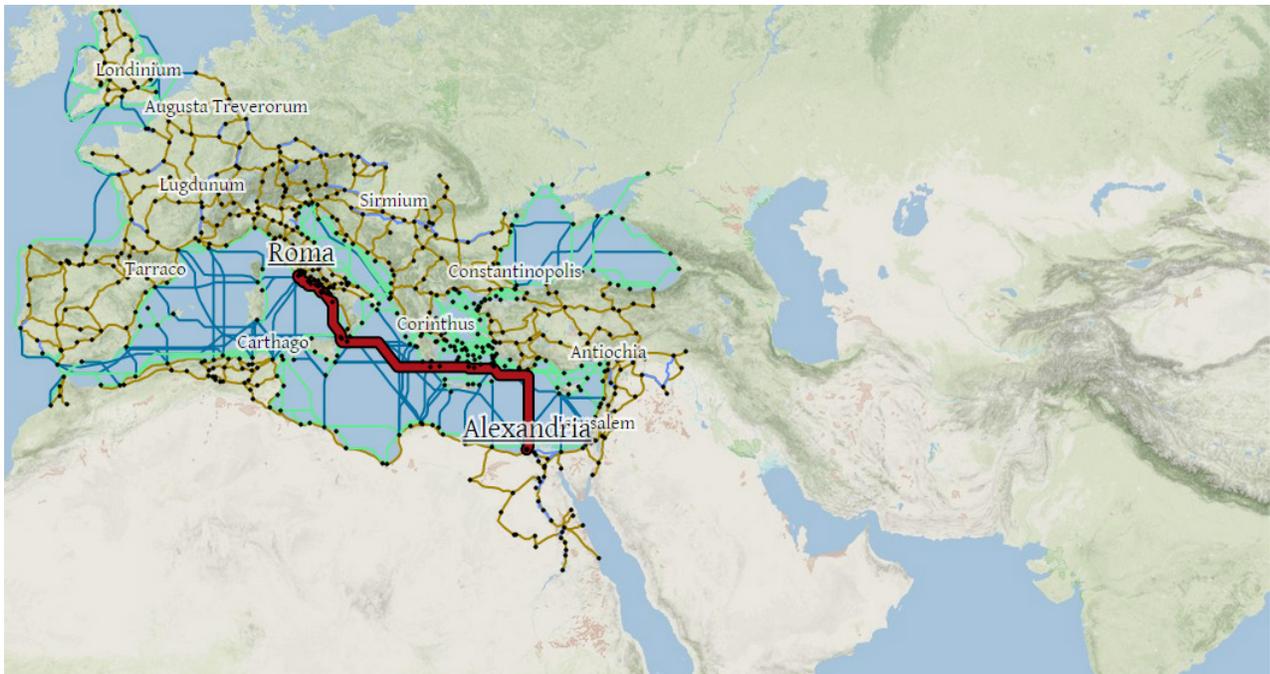


Figure 2. Trade Routes in the Roman Empire. Brown routes represent roadways, blue and green routes are water routes, red route represents fastest path from Alexandria to Egypt. (Walter Scheidel, Orbis.)

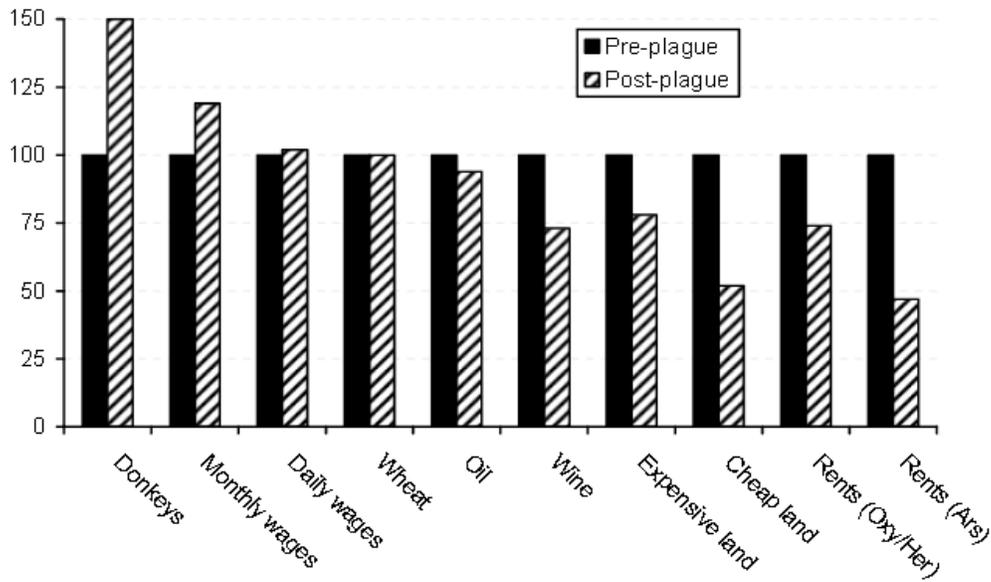


Figure 1 Changes in real prices and rents between 100-160s and 190s-260s CE

Figure 3. Data on Pre- to Post- Antonine Plague Prices and Rents in Roman Egypt. (Walter Scheidel, “A Model of Demographic and Economic Change in Roman Egypt after the Antonine Plague.”)

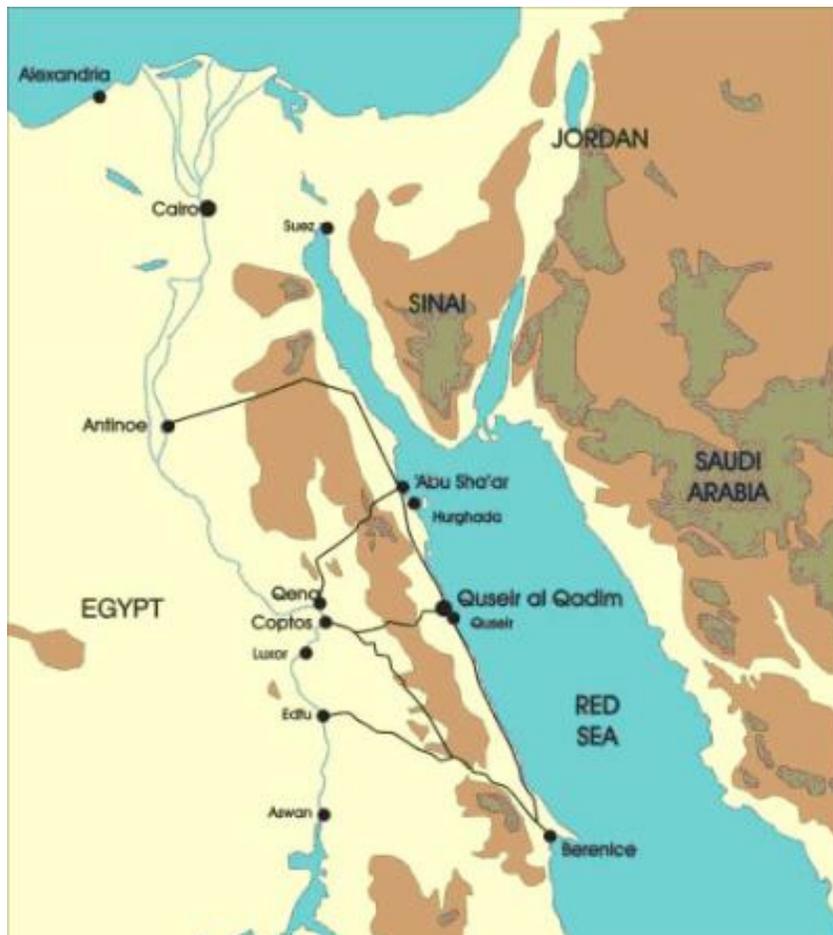


Figure 4. Trade Route from India (not shown) to Quseir al Qadim and Other Red Sea Ports to Alexandria. Black lines indicate travel by road, blue lines indicate travel along the Nile River. (The Red Sea Governate, redsea.gov.eg.)