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Egypt as a Gateway for the Passage of Pathogens into the Ancient Mediterranean Egypt had a reputation in the Greco-Roman Mediterranean region as a gateway for disease—a source of pestilence that originated south of Egypt and spread north via the Nile River, an important transport axis, from the regions of inner Africa south of the first Nile cataracts or through the Red Sea (Fig. 1). Thucydides was not the first to attribute the origin of an epidemic to northeast Africa, specifically *Aithiopia*, but his narrative inspired subsequent ancient authors who imitated his account when reporting on the "plagues" of their time. It is important to investigate the veracity of those later accounts that also point to "Aithiopia" as the origin of pestilence. This is only possible with thorough investigation of all available sources, including the latest archaeological and archaeogenetic discoveries, as well as analysis of the Egyptian papyrological evidence.

Of special significance is the role Egypt and the Red Sea most likely played in the spread of the Justinianic Plague (541–544 C.E.), the initial wave of the First Plague Pandemic. Archaeogenetics

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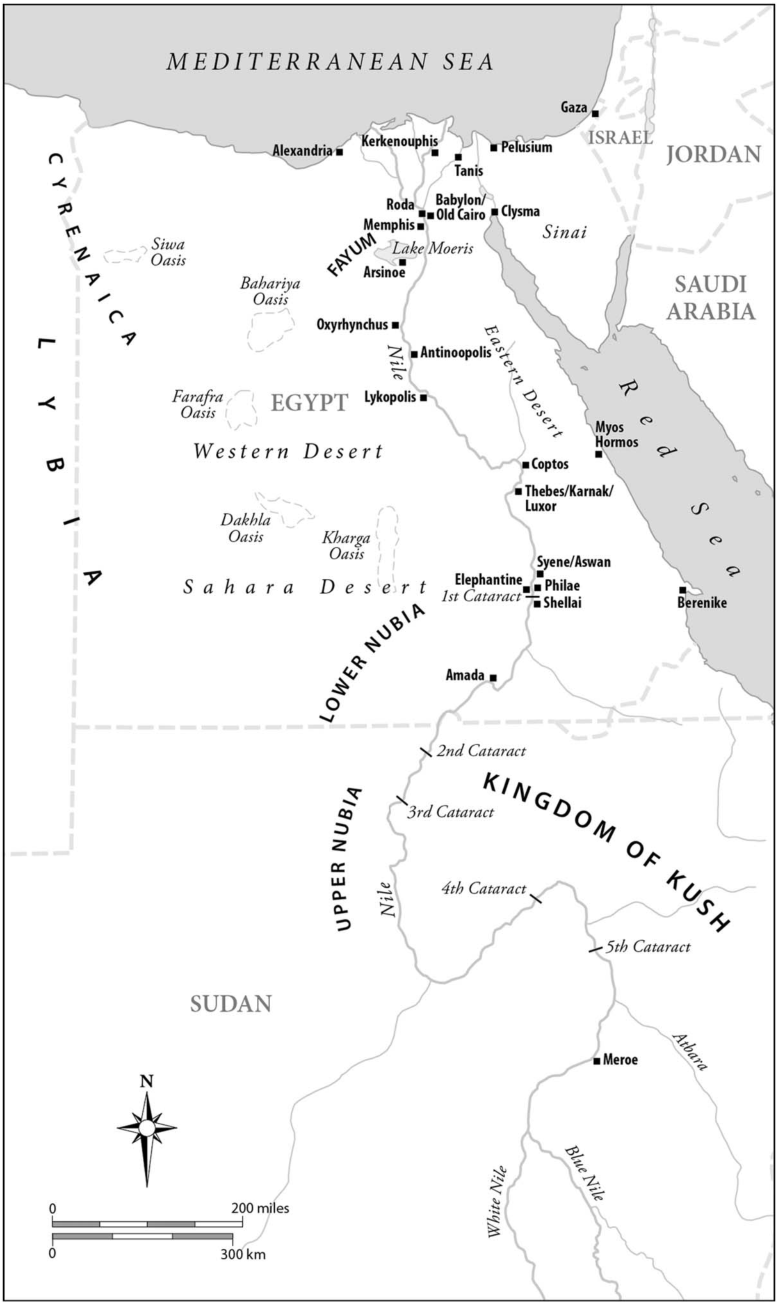
Fig. 1 Egypt and Northeast Africa in Antiquity, with Modern Geographical Boundaries



have confirmed that the pathogenic agent of the Justinianic Plague and the First Plague Pandemic in the centuries that followed was true plague (either in bubonic, pneumonic, or septicemic form), caused by the bacterium *Yersinia pestis*. Knowledge of the pathogen responsible for the pandemic allows confident hypotheses relating to the epidemiology and ecology of plague, including environmental parameters, carriers, vectors, and the bacterium's ultimate origin. Conversely, cases where the responsible pathogen is unknown, such as the Antonine Plague, rely heavily on limited and speculative analyses using ancient written evidence for retrospective diagnosis.[1]

This article delves into the discussion about disease events in the ancient Mediterranean region, with a specific focus on Egypt and civilizations of the western Indian Ocean (including the Red Sea). Critically examining the archaeology and scientific findings, exhaustively considering the papyrological sources, and disentangling literary topoi from actual observations significantly improves our understanding of Egypt's role in the circulation of pathogens between Asia, Africa, and the Mediterranean.

NATURAL LANDSCAPES OF EGYPT AND NORTHEASTERN AFRICA

Understanding ecological contexts is crucial for historical epidemiology. Egypt's environmental landscape is characterized by Mediterranean coastal settings, including the Nile delta and its intricate canal system, in the north; the Libyan Sahara in the west; and the Egyptian Sahara, the Red Sea, and the Arabian Desert in the east. The region also has semi-deserts, as well as the Fayum and the oases situated in the Western Desert of the Egyptian Sahara. The most notable environmental feature is the Nile River and its valley, which serves as a lifeline in the hostile desert south of the delta. Apart from a few oases, the Nile valley and the delta were the sole basis for Egyptian agriculture in antiquity.

Egypt lies within the North African dry belt and predominately has a desert climate. South of Cairo, rainfall is less than 5 mm annually, and summer temperatures range between 30° and 40° C. The Mediterranean coastline and the delta have more

1 A pathogen's *ultimate* origin refers to its geographical place of origin, while its *proximate* origin is the place where a pathogen focalized after emergence and spread before igniting a particular disease event. Understanding the ultimate or proximate origin of a pathogen is crucial for its historiography, as it allows for tracking a pathogen's movement prior to documented outbreaks. See below for evidence on the Justinianic Plague.

moderate climates, receiving 100–200 mm of annual precipitation and mean annual summer temperatures ranging between 20° and 29° C. Paleoclimatic and paleoenvironmental data indicate that the climatic regime of Greco-Roman Egypt probably did not differ much from today's, in contrast to the substantial climatic transition that occurred in northeast Africa between the fifth and fourth millennia B.C.E.[2]

In antiquity, Nile floods were in large part a result of monsoons originating from the Indian Ocean. These monsoons, moderated by the Intertropical Convergence Zone (the convergence of northeastern and southeastern trade winds), brought rains to the East African lakes situated in the Ethiopian Highlands—the headwaters of the Blue and Atbarah Niles. Before twentieth-century damming, East African/Indian Ocean monsoonal rains caused the Nile to rise. A strong monsoon would lead to higher river discharge, and a weaker monsoon reduced the flow of the Nile, interrupting the supply of fertile silt to the fields along the valley and in the delta. The Nile River not only provided water for irrigation and fertile silt, but also acted as a central route of transport through northeast Africa.[3]

In Ptolemaic and Roman/Byzantine times, Egypt was at the crossroads of trade with Inner Africa, East Africa, Arabia, and south Asia (Fig. 2). The southernmost commercial hubs for riverine trade with Inner Africa were located in the First Cataract region, including Syene (modern Aswan), Elephantine Island, and Philae. This region south of Egypt's border, known as Kush—or Aithiopia by ancient Greeks—was at the nexus of cross-cultural trade routes over several millennia, serving as a major port for ivory tusks, ebony, slaves, tropical bird feathers, and precious stones. Cargo

2 World Meteorological Organization, World Weather Information Service, available at https://worldweather.wmo.int (accessed Sept. 3, 2022); Rudolph Kuper, "After 5000 BC: The Libyan Desert in Transition," *Comptes Rendus Palevol*, V (2006), 409–419; Stephan Kröpelin et al., "Climate-Driven Ecosystem Succession in the Sahara: The Past 6000 Years," *Science,* CCCXX (2008), 765–768; Xiaoshuang Zhao et al., "Migration of the Intertropical Convergence Zone in North Africa during the Holocene: Evidence from Variations in Quartz Grain Roundness in the Lower Nile Valley, Egypt," *Quaternary International*, CDXLIX (2017), 22–28.

3 For a review of the climatological cycle of the East African monsoon system, part of the wider Indo-Pacific-Asian monsoon cycle, see Chris Funk et al., "The East African Monsoon System: Seasonal Climatologies and Recent Variations," in Leila Maria Véspoli de Carvalho and Charles Jones (eds.), *The Monsoons and Climate Change: Observations and Modeling* (Cham, Switzerland, 2016), 163–185.

boats were unloaded on one side of the cataract, and goods were transported by land and reloaded on the other side. Military garrisons were stationed here in Pharaonic, Ptolemaic, and Roman times. Philae, located slightly south of Syene, was inhabited by a mix of Egyptian and Aithiopian peoples. The area remained a cultural contact zone well into the Byzantine and Islamic periods. This region has a subtropical desert climate, with mild winters and very hot summers.[4]

Ancient trade routes connected Egypt to ports of the western Indian Ocean, such as Rhapta (although its location in East Africa remains unidentified), those along the southern coast of Arabia, and those of South Asia. The Red Sea and the Eastern Desert were vital to linking trade between Indian Ocean and Mediterranean societies. The trade route to and from India was over 4,500 km along coasts to Red Sea port towns Berenike and Myos Hormos, taking advantage of monsoonal winds that facilitated sailing. Once reaching Egyptian port cities, goods were transferred to draught animals and transported via desert caravan routes to the Nile emporium Coptos (or to Apollonopolis from Berenike in the Ptolemaic period). For centuries, Coptos, Berenike, and Myos Hormos (until the early third century C.E.) were crucial to facilitating trade between the Mediterranean world (including Egypt) and southern Arabia, East Africa, and South Asia. Once goods reached Nile emporia, they were loaded onto river boats and transported to northern Egyptian ports Alexandria and Pelusium for shipment into the Mediterranean.[5]

An alternative route into the Nile delta was Trajan's Canal—an artificial waterway that connected the Red Sea with the eastern delta. This route gained importance in late antiquity after the Eastern Desert underwent a transition: Myos Hormos

4 Strabo, *Geography*, 1.2.32; *ibid.*, 17.1.49; Josef Locher, *Topographie und Geschichte der Region am ersten Nilkatarakt in griechisch-römischer Zeit* (Stuttgart, 1999); László Török, "Between Egypt and Meroitic Nubia: The Southern Frontier Region," in Christina Riggs (ed.), *The Oxford Handbook of Roman Egypt* (Oxford, 2012), 749; Stefanie Schmidt, "Economic Conditions for Merchants and Traders at the Border between Egypt and Nubia in Early Islamic Times," in Huebner et al. (eds.), *Living the End of Antiquity: Individual Histories from Byzantine to Islamic Egypt* (Berlin, 2020), 265–287; Schmidt, "Zum Grenzhandel am Ersten Katarakt. Regionale Entwicklungen zwischen Spätantike und frühislamischer Zeit," in Rudolf Haensch and Philip von Rummel (eds.), *Himmelwärts und Erdverbunden?* (Berlin, 2021), 323–335.

5 Steven E. Sidebotham, *Berenike and the Ancient Maritime Spice Route* (Berkeley, 2011), 35–36; James Beresford, *The Ancient Sailing Season* (Leiden, 2012).

was abandoned, power at Berenike likely shifted to northeast African peoples, and Clysma was established as the main Roman port of the Red Sea. In the western Nile delta, there was a land route linking Alexandria with Cyrenaica and Roman North Africa.[6]

Egypt's Western Desert—the portion of the Sahara west of the Nile River—is hyper-arid, receiving less than 5 mm of rain per year (Fig. 1). The main source of water in the region was the Nubian Sandstone aquifer, the world's largest fossil water aquifer, spanning beneath areas of modern-day Libya, Egypt, Sudan, and Chad. The oases in the Western Desert—a result of the aquifer—were distinct but connected via communication routes, facilitating trade and travel. These routes extended from the Nile valley westward through the Kharga and Dakhla oases, and northward from Dakhla through the Farafra, Bahariya, and Siwa oases. Links with the Nile were crucial to the function of oasis settlements in the Roman period, most being remote desert locations at the imperial frontier. Because they were remote, taxable entities of the empire, these estates relied on imports and exports to live above subsistence agriculture. Other than the Western Desert oases, the Fayum, the Nile delta, and the Nile valley, the rest of Egypt consisted of inhospitable desert terrain that could not sustain societies without the importation of resources.[7]

Although the harsh desert landscapes of Egypt do not generally serve as disease foci, Egypt's Mediterranean coastline, the Nile delta, the Nile valley, and areas along the Red Sea coast do have environmental conditions—plant life and hydrological settings in

6 PSI 87; PSI 689; Gregory of Tours, *History of the Franks* 1.10; Frederico De Romanis, "Traianos potamos. Mediterraneo e Mar Rosso da Traiano a Maometto," in Rosario Villari (ed.), *Controllo degli stretti e insediamenti militari nel Mediterraneo* (Rome, 2002), 21–70; John P. Cooper, "Egypt's Nile-Red Sea Canals: Chronology, Location, Seasonality and Function," in Lucy Blue et al. (eds.), *Connected Hinterlands: Proceedings of Red Sea Project IV Held at the University of Southampton September 2008* (Oxford, 2009), 195–209; Raoul McLaughlin, *Rome and the Distant East: Trade Routes to the Ancient Lands of Arabia, India and China* (Auckland, 2010); Sidebotham, *Berenike*; McDonald, "The Downturn of Egypt's Eastern Desert in the Middle Roman Imperial Period," *Journal of Egyptian Archaeology*, CX (2024). Michael McCormick, *Origins of the European Economy: Communications and Commerce AD 300–900* (Cambridge, 2001), 450.

7 Roger S. Bagnall et al., *An Oasis City* (New York, 2015), 150; Bagnall and Gaëlle Tallet, *The Great Oasis of Egypt* (Cambridge, 2019), 8–9; Frédéric Colin et al., "The End of the 'Green Oasis': Chronological Bayesian Modeling of Human and Environmental Dynamics in the Bahariya Area (Egyptian Sahara) from Pharaonic Third Intermediate Period to Medieval Times," *Radiocarbon*, LXII (2020), 25–49.

particular—that can support animal reservoirs and vectors of certain pathogens, such as those linked to *Y. pestis*, waterborne diseases like *Salmonella enterica* serovars, and, historically, malaria. The landscapes of northeast Africa south of Egypt, in which ancient Aithiopia was situated, spans modern-day Sudan, South Sudan, Eritrea, Djibouti, Ethiopia, Somalia, Kenya, and Uganda. Many areas of this region are conducive to supporting pathogens due to their ecological features. The numerous lakes, rivers, and wetlands, and major diversity in terrain—especially soils and natural vegetation—provide favorable conditions for pathogenic reservoirs (especially birds and mammals) and insect vectors. At present, East Africa is home to a multitude of endemic zoonotic diseases and is a global hotspot for emerging infectious diseases.[8]

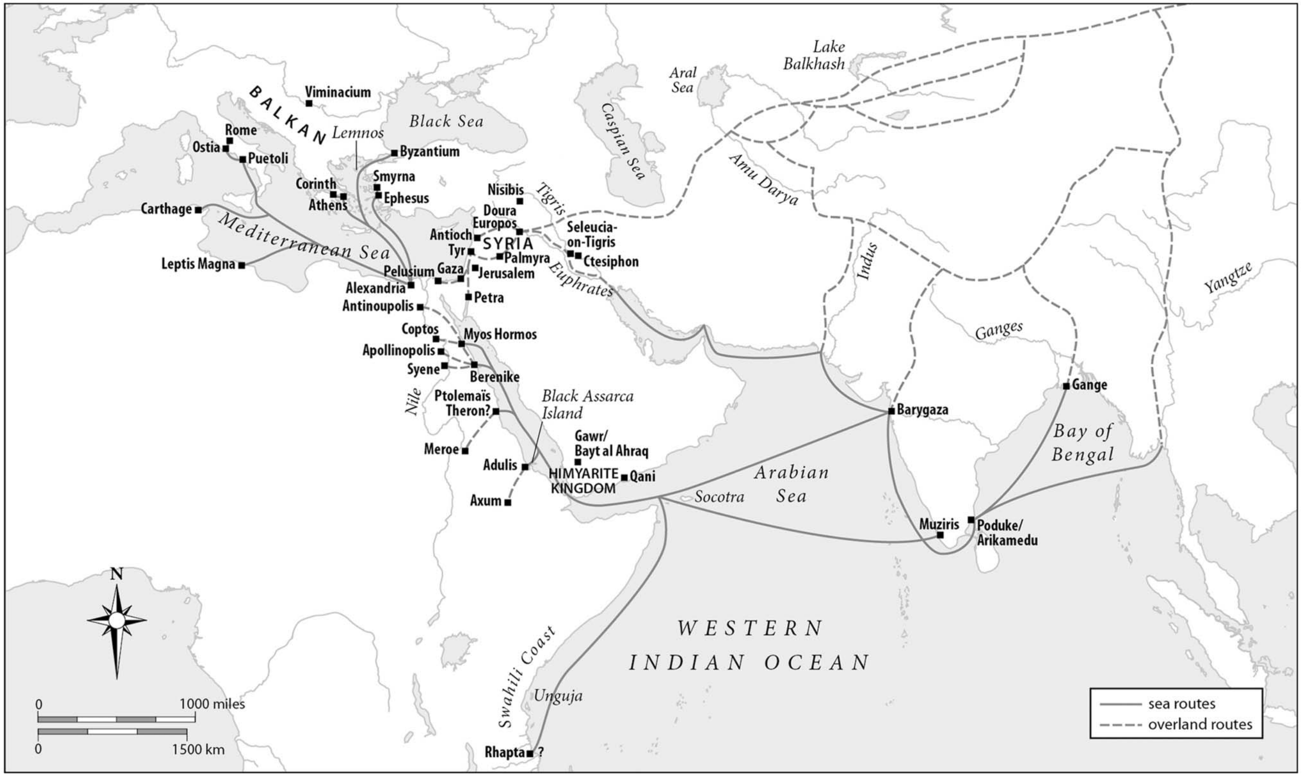
The geography of the lands known to the ancient Greeks as Aithiopia is ill-defined, with some sources indicating it as the region immediately south of Egypt, including lower and upper ancient Nubia (modern Sudan, Fig. 1), while in other cases, it also encompassed modern Eritrea and the Tigray Region of modern Ethiopia. Some sources used *Aithiopia* to denote all lands south and east of Egypt, and a few sixth-century Byzantine authors even referred to the same geographical area as *India*.[9]

Ancient authors situate the origin of certain disease events in Aithiopia. Pathogens endemic in northeastern Africa today include malaria, tuberculosis, yellow fever, Chikungunya, Rift Valley Fever

8 Helmut Kloos and Ahmed Zein, *The Ecology of Health and Disease in Ethiopia* (Oxford, 1993); A. Aseffa, "Viral Diseases in Ethiopia: A Review," *East African Medical Journal,* X (1993), 624–626; Naomi Kemunto et al., "Zoonotic Disease Research in East Africa," *BMC Infectious Diseases*, XVIII (2018), 1–9; Monica Green and Lori Jones, "The Evolution and Spread of Major Human Diseases in the Indian Ocean World," in Gwyn Campbell and Eva-Marie Knoll (eds.), *Disease Dispersion and Impact in the Indian Ocean World* (London, 2020), 25–57; Patricia Crone, *Meccan Trade and the Rise of Islam* (Piscataway, 1987), 31; Florence Fenollar and Oleg Mediannikov, "Emerging Infectious Diseases in Africa in the 21st Century," *New Microbes and New Infections*, XXVI (2018), 10–18.

9 Peter Sarris, "The Justinianic Plague: Origins and Effects," *Continuity and Change*, XVII (2002), 171–173; Török, *Herodotus in Nubia* (Leiden, 2014), x–xi, n. 16. On the etymology and use of *Aithiopia*, *Kush*, and *Axum* in ancient literature, see Stuart Munro-Hay, "The Foreign Trade of the Aksumite Port of Adulis," *Azania*, XVII (1982), 107–125; *idem*, "Kings and Kingdoms of Ancient Nubia," *Rassegna Di Studi Etiopici*, XXIX (1982), 87–137; *idem*, *Aksum: An African Civilisation of Late Antiquity* (Edinburgh, 1991), 15–16, 54–55; McCormick, "Toward a Molecular History of the Justinianic Pandemic," in Lester K. Little (ed.), *Plague and the End of Antiquity: The Pandemic of 541–750* (Cambridge, 2006), 304; George Hatke, *Aksum and Nubia* (New York, 2013), 3.3.2.

Fig. 2 Communication Routes in Antiquity



(RVF), HIV/AIDS, hepatitis B, hepatitis C, helminthic parasites, cutaneous leishmaniasis, and pathogens that parasitize other animals.[10]

Given that the natural landscapes of northeastern Africa have not changed dramatically between antiquity and today, it is plausible that areas south of Egypt also harbored virulent microbes in Greco-Roman times. But our current understanding of the area's past pathogenic landscape is limited, making it difficult to determine whether ancient writers truly knew the origin of the diseases that they associated with the region. Conversely, it is wrong to assume that the ancient region did not harbor pathogens capable of spreading to Egypt or to dismiss all ancient claims of pestilence originating there as fantastical. Considering Egypt's geographical position and its trade connections with East and Inner Africa, Arabia, and South Asia, coupled with the facilitation of movements through Egypt by past ruling powers, it is necessary to acknowledge that ancient claims of epidemics stemming from Aithiopia (for our purposes, the area of East Africa south of Egypt) may not all be dubious.

THE PLAGUE OF ATHENS Egypt's first explicit connection to a major outbreak of disease in classical literature is Thucydides' well-known account of the Plague of Athens. In 431 B.C.E., during the Spartan invasion of the land surrounding Athens, the Athenian general Pericles advised the population to seek refuge within the newly constructed Long Walls that connected Athens to its port, Piraeus, unintentionally creating an environment prime for the spread of infectious disease. The space between the walls became a vast refugee camp of at least 100,000 people, compromised by an inadequate sanitation system and stifling summer heat. Thucydides, the sole source of information on the plague, described its quick spread from Piraeus to Athens, where it is estimated to have killed 30,000 citizens, or roughly one-to two-thirds of the Athenian population.[11]

Thucydides highlights the unsanitary conditions in war-time Athens and recounts the belief among some Athenians that the Spartans had poisoned the wells—apparently, the Athenians had a hunch that the quality of their drinking water was to blame.

10 See n. 8.

11 Thucydides (trans. Richard Crawley), *History of the Peloponnesian War* (London, 1910), 2.47–54, 2.57–58.

Thucydides' description suggests that the disease was easily transmissible through contact with the infected, and survivors acquired immunity. Thucydides reports from hearsay that the plague started in Aithiopia and spread to Egypt, Libya, and parts of the Persian Empire. Of course, Thucydides was not an eyewitness and did not know when the disease emerged or how long the respective outbreaks lasted.[12]

When Thucydides reported Aithiopia as the pestilence's place of origin, the region he meant likely corresponds to the understanding of Homer and Herodotus. In the eighth century B.C.E., Homer defined Aithiopia as the region south of Egypt, beginning in Elephantine at the first Nile cataract and extending south and east to the shores of the Red Sea (Fig. 1). This definition broadly aligns with the ancient Kingdom of Kush, which existed from around 1000 B.C.E. to the fourth century C.E., and varied in geographical extent over that span. In the minds of these ancient authors, Aithiopia held positive connotations, being associated with one of the most ancient cultures that predated and contributed significantly to Egyptian civilization. Yet, even in Homer's *Iliad*, pestilence is associated with Aithiopia when the Greek army before Troy succumbs to a plague while the gods are away on vacation with the "blameless Aithiopians."[13]

Although the symptoms described by Thucydides must be evaluated with caution and the challenges of retrospective diagnoses kept in mind, it is valuable to consider his symptomatology for

12 Thucydides, *Peloponnesian War*, 2.49, 2.51, 2.48.1–2. Cf. Richard Duncan-Jones, "The Impact of the Antonine Plague," *Journal of Roman Archaeology*, IX (1996), 114; *idem*, "The Antonine Plague Revisited," *Arctos*, LII (2018), 41–72. For the plague in Rome, see Eiffie Coughanowr, "The Plague in Livy and Thucydides," *L'Antiquité Classique*, LIV (1985), 152–158.

13 Homer, *Odyssey*, 2.2.24. Cf. Strabo, *Geography* 1.12.27; Pliny, *The Natural History*, 5.8.43; Diodorus Siculus, *The Library of History*, 3.2. The Greek name *Aithiopia* translates literally as "burnt-face," a reference to dark skin, a term that was extended more broadly to all populations deriving from inner Africa and India. Cf. Lloyd A. Thompson, *Romans and Blacks* (London, 1989), 59, 92; David W. Phillipson, *Ancient Ethiopia. Aksum: Its Antecedents and Successors* (London, 1998); *idem*, *Foundations of an African Civilisation: Aksum and the Northern Horn, 1000 BC–AD 1300* (Woodbridge, U.K., 2012); Christian J. Robin, "Arabia and Ethiopia," in Scott F. Johnson (ed.), *The Oxford Handbook of Late Antiquity* (Oxford, 2012), 247–334; Homer, *Iliad*, 1.422; Sarah Derbew, *Untangling Blackness in Greek Antiquity* (Princeton, 2022), 57. On ancient East Africa, see Giovanni Ruffini, *Medieval Nubia: A Social and Economic History* (Oxford, 2012); Geoff Emberling and Bruce Williams (eds.), *The Oxford Handbook of Ancient Nubia* (Oxford, 2021).

potential insights. Thucydides gives a historian's point of view, making interpretation even more complex. According to his description, victims of the pestilence suffered from red inflamed eyes, bloody throat and tongue, coughing, spasms, fever, reddish skin, small pustules and ulcers, internal burning, unquenchable thirst, insomnia, severe diarrhea, necrosis of the extremities, and loss of eyesight. Thucydides also says that the disease was indiscriminate, affecting people regardless of age or health, and had a high mortality rate. Sallares explored various candidates for the Athenian pestilence, including influenza, measles, typhus, typhoid fever, and bubonic plague, but considered smallpox the most likely culprit, even though Thucydides does not mention life-long scarring typical of smallpox survivors. Another possibility is a viral hemorrhagic fever such as Ebola, but, without retrieval of usable molecular material from human remains for further archaeogenetic investigations, the responsible pathogen remains undetermined.[14]

Thucydides held a prominent position in ancient literature and education and was widely studied from the Hellenistic period to late antiquity. Many ancient historians aimed to emulate Thucydides' style, and his influence extended into the Byzantine period. His work ensured that the devastating impact of the plague was widely known, and as a result later disease narratives were styled on his account. It is not surprising that the Greco-Roman world exhibited some prejudice about Aithiopia as the origin of pestilence, and believed that its diseases reached the ancient Mediterranean through Egypt.[15]

PLAGUE IN EGYPT FROM PHARAONIC TO EARLY ROMAN TIMES Thucydides was not the first to discuss pestilence in the context of Egypt. There are references to epidemic diseases in sources from the late Bronze Age, including the Amarma letters, which date to the fourteenth century B.C.E. These references mention fatal epidemics in Egypt and various regions of the Levant. Some scholars believe that

14 Thucydides, *Peloponnesian War*, 2.49.2–8. Robert Sallares, *The Ecology of the Ancient Greek World* (Ithaca, 1991), 244–262; cf. Burke A. Cunha, "The Cause of the Plague of Athens: Plague, Typhoid, Typhus, Smallpox, or Measles?" *Infectious Disease Clinics of North America,* XVIII (2004), 29–43; Robert J. Littman, "The Plague of Athens: Epidemiology and Paleopathology," *Mount Sinai Journal of Medicine,* LXXVI (2009), 465–466.

15 Raffaella Cribiore, *Gymnastics of the Mind* (Princeton, 2001), 144; Susan A. Stephens, "Who Read Ancient Novels?" in Gregory Nagy (ed.), *Greek Literature in the Roman Period and in Late Antiquity* (New York, 2014), 269.

these epidemics were outbreaks of bubonic plague; the Ebers papyrus, belonging to the surviving Egyptian medical literature from the middle of the second millennium B.C.E., records that "[the disease] produced a bubo, and the pus has petrified," potentially referring to bubonic plauge. Bubonic plague is an infection of the lymphatic system beginning with a bite from an insect, usually a flea, infected with *Y. pestis*, and materializes as swollen lymph nodes (or buboes) typically in the groin, arms, and knees. Thus, interpreting the above as bubonic plague is tenuous without more precise symptomatology.[16]

During the Dahamunzu Affair of the Amarna period in the fourteenth century B.C.E., it was believed that Egyptian war captives brought an infectious disease to Anatolia, resulting in a significant loss of life over the next twenty years, including Šuppiluliuma I, the Great King of the Hittites, and his son and successor, Arnuwanda II. Clay tablets from Hattuša, the Hittite capital, document the introduction of a previously unknown plague to the empire following a successful retaliatory attack on the Egyptians. Five such tablets have survived, carrying the inscription of a prayer of King Muršili II (a younger son of Šuppiluliuma I), in which the king seeks divine intervention to alleviate pestilence from the land of Hatti.[17]

16 Anson F. Rainey (ed.), *The El-Amarna Correspondence: A New Edition of the Cuneiform Letters from the Site of El-Amarna Based on Collations of All Extant Tablets* (Leiden, 2014), numbers 11, 35, 96, 244, 362; Graciela Gestoso Singer, "Beyond Amarna: The 'Hand of Nergal' and the Plague in the Levant," *Ugarit Forschungen,* XLVIII (2017), 223–247; Bendiz Ebbell (trans.), *The Papyrus Ebers* (Oxford, 1937), col. 39.3–7 recipe 196. See also London Medical Papyrus 15, 8–10; Hearst Papyrus H X1, 12–15. Hans Goedicke, "Plague," in Hans Wolfgang Helck and Wolfhart Westendorf (eds.), *Lexicon of Egyptology* (Wiesbaden, 1984), V, 918–919; *idem*, "The Canaanite Illness," in Hartwig Altenmüller and Dietrich Wildung (eds.), *Studien zur Altägyptischen Kultur* (Hamburg, 1984), XI, 91–105; Eva Panagiotakopulu, "Pharaonic Egypt and the Origins of Plague," *Journal of Biogeography*, XXXI (2004), 269–275. Michael E. Habicht, Patrick E. Eppenberger, and Frank Rühli, "A Critical Assessment of Proposed Outbreaks of Plague and Other Epidemic Diseases in Ancient Egypt," *International Journal of Infectious Disease*, CIII (2021), 217–219. On nearly contemporaneous occurences of bubonic plauge, see Maria Spyrou et al., "Analysis of 3800-Year-Old *Yersinia pestis* Genomes Suggests Bronze Age Origin for Bubonic Plague," *Nature Communications*, IX (2018); Monica Green, "Putting Africa on the Black Death Map: Narratives from Genetics and History," *Afriques*, IX (2018), available at doi.org/10.4000/afriques.2125.

17 Emmanuel Laroche, *Catalogue des textes hittites* (Paris, 1971), numbers 376–379; Itamar Singer, *Writings from the Ancient World: Hittite Prayers* (Atlanta, 2002), 47–69; Marc V. D. Mieroop, *A History of the Ancient Near East, ca. 3000–323 BC* (Chichester, 2016; orig. pub. 2004), 247–250.

In the seventh century B.C.E., Sennacherib, the king of Assyria, sought to put down rebellions in Judea reportedly instigated by Pharaoh Sethos in Egypt. The Assyrians' siege of Pelusium was short-lived, and Herodotus describes how they were overcome by hordes of field mice in their camp. The mouse was the Greek symbol of pestilence; Apollon Smintheus, both the god and killer of mice, was said to be responsible for spreading and ending epidemics with his arrow. The Old Testament attributes the destruction of the Assyrian army besieging Jerusalem to the hand of Yahweh, later interpreted by Flavius Josephus as a pestilence that killed 185,000 Assyrians on the first night of the siege.[18]

The Old Testament also holds that Egypt was the ancient world's cradle of disease. The sixth Egyptian plague, described in Exodus, was an acute epidemic disease manifesting externally as boils that eventually formed into skin ulcers, a symptom characteristic of a poxvirus. Deuteronomy, thought to have been written in Jerusalem between the eighth to sixth century B.C.E., distinguishes lethal buboes (called the "boils of Egypt") afflicting various parts of the body including the knees and legs, which could be a reference to bubonic plague, from other skin diseases and rashes.[19]

According to the biblical account, the Philistines, an ancient people in the south of Israel who briefly captured the Ark of the Covenant (1 Samuel 5–6), experienced a devastating pestilence characterized by tumors of the groin. The Hebrew Bible and the Septuagint say that this pestilence occurred simultaneously with a rodent pestilence, further contributing to death and destruction throughout the city of Ashdod. In the fifth century B.C.E., Herodotus allegedly traveled extensively in Egypt but—in stark contrast to the ancient Near Eastern sources—did not mention the diseases that Greek medical authors claim were endemic to Egypt. In fact, he considered the Egyptians to be not only the most learned but also "the healthiest of all men next after the Libyans."[20]

References to pestilence from the Hellenistic period are rare. One example comes from a funerary epigram by Antipater of

18 Homer, *Iliad*, 1.39, 44–54; 2 Kings 19:6–7, 35; Isaiah 37:36–37; Flavius Josephus, *Antiquities of the Jews*, 10.17.21. James B. Pritchard, *Ancient Near Eastern Texts Relating to the Old Testament* (Princeton, 1955; orig. pub. 1950), 394–396; Amélie Kuhrt, *The Ancient Near East, c. 3000–330 BC* (London, 1995), I, 275–276; Singer, *Hittite Prayers*, 57–61.

19 Deuteronomy 28:27, 35; Exodus 9:8–11. Jan Christian Gertz, *Das Deuteronomium* (Göttingen, 2019), 253.

20 1 Samuel 5:6; Herodotus, *The Histories*, 2.77.3.

Sidon, which laments the death of Ptolemy Eupator, a fourteen-year-old Ptolemaic prince who died in the summer of 152 B.C.E. from a pestilence that apparently caused widespread devastation in Egypt. The specific nature of the disease was not mentioned. The next reference to pestilence, either occurring in or said to have come from Egypt, is by Appian in 46 B.C.E., toward the end of the Hellenistic period. According to Appian, Cleopatra VII refused to send ships to Cassius "on the grounds that Egypt was at the time suffering from famine and pestilence."[21]

Rufus of Ephesus, a physician during the reign of Trajan (97–117 C.E.), recounts a disease that caused pestilential buboes. Rufus thoroughly reviewed the medical journals of his Greek predecessors, and his own treatises, some of which were based on those earlier works, left a notable impact on the Greek-speaking eastern Roman world. Most of Rufus' works are lost, but fragments survive in various sources, including a medical companion compiled by Oribasius in the fourth century C.E.[22]

Rufus' account leaves little doubt that the cases he describes are instances of bubonic plague:

> Then there are the *boubones* called pestilential [*loimodeis*], which are especially seen around Libya and Egypt and Syria, and are most deadly and highly acute. Dionysius Kurtos and his followers make mention of them. Dioscorides and Posidonius offer the most details in their writing on the plague that occurred in Libya in their time. And they said that a sharp fever followed closely and terrible pain, disturbance of the entire body, and delirium and the swelling of *bubones* that are large, hard, and not suppurating, not only in the accustomed places, but also on the part behind the knee and at the bend of the arm, although such inflammations do not happen there at all.

Aretaeus of Cappadocia, another Greek physician who practiced in the second century C.E., mentions an epidemic characterized by buboes in the groin, though the extent of his familiarity with the disease is unclear.[23]

21 *Anthologia Graeca*, 7.241; Appian, *The Civil Wars*, 4.61.

22 John Mulhall, "Plague before the Pandemics: The Greek Medical Evidence for Bubonic Plague before the Sixth Century," *Bulletin of the History of Medicine*, XCIII (2019), 168, 170–174. Oribasius, *Medical Collections*, 44.14.

23 Cf. Scheidel, *Death on the Nile*, 99; Sallares, "Ecology, Evolution, and Epidemiology of Plague," in Little (ed.), *End of Antiquity*, 231–289; for a translation of Rufus, see Mulhall, "Plague before the Pandemics," 166.

There is a complete absence of reference to disease in the papyrological record of the Hellenistic period. The earliest potential references date to the Roman period, specifically the late first and early second centuries C.E. and later, and come from letters, death registrations, and mummy labels that record two or more family members dying around the same time. But, even if such evidence points to epidemic disease, it is usually difficult to assign it to a known pandemic since the papyrus texts are often not precisely dated and can only be roughly classified chronologically with paleography. One example is a death registration on papyrus that records the death of two relatives at Oxyrhynchus in middle Egypt, which Casanova linked to the Hadrianic plague, a pandemic in Emperor Hadrian's reign (117–138 C.E.) that is mentioned in passing in the *Historia Augusta*, and whose geographical scope and exact chronology are unknown. A second-century C.E. papyrus from the Fayum region also showcases evidence of numerous deaths within the same household, which could be connected to the Hadrianic plague.[24]

There are two potential references that may each pertain to the same pestilence, which likely predates the Antonine Plague. One is a letter from a man named Lykarion to his father, Psonthuonsi, who had been traveling abroad in the first or early second century C.E. Lykarion explains that multiple members of their household had died that year, referring to a "great dying." The same expression is used in a papyrus letter dated to the first quarter of the second century C.E. from Karanis in the Fayum. This letter writer, a woman named Taeis, reports of many deaths that occurred in Alexandria. Given the lack of precise dating and detailed symptomatology, attributing these deaths to the Hadrianic pestilence, the bubonic plague epidemics reported by Rufus, or a hitherto unknown epidemic in Egypt would be problematic.[25]

Similarly, wooden mummy labels from the Roman period are suggestive of death by infectious disease. These labels, created in

24 *P. Oxy.* 12.1550; see also *CPGr* 2.26. Gerardo Casanova, "Epidemie e fame nella documentazione greca d'Egitto," *Aegyptus*, LXIV (1984), 163–201; *idem*, "Altre testimonianze sulla peste in Egitto. Certezze ed ipotesi," *Aegyptus*, LXVIII (1988), 93–97. Casanova follows the dating by Vitelli to 116 C.E., but 135 C.E. or 156 C.E. are also possible. Cf. Martin David, Bernhard A. Van Groningen, and Emil Kiessling, *Berichtigungsliste der Griechischen Papyrusurkunden aus Ägypten IV* (Leiden, 1964), 62. *BGU* 13.2242. See also Herwig Maehler, "Anzeige eines Einbruchs," *Aegyptus*, XLVII (1967), 222–225.

25 *Stud.Pal.* 22.33, l.7–12; *P.Mich.* 8.510. For dating, see Silvia Strassi, "In margine all'archivio di Tiberianus e Terentianus: *P.Mich.* VIII 510.," *Zeitschrift für Papyrologie und Epigraphik*, CXLVIII (2004), 225–234.

pairs from the same piece of wood, indicate sequential deaths of several family members within a short period. The growth pattern in the wood confirms their consecutive production. None can be dated with certainty, making it impossible to attribute them to a known disease event in Roman times.[26]

THE ANTONINE PANDEMIC The Roman Empire faced a virulent pandemic from the mid-160s C.E. until possibly 190 C.E., the extent and effects of which are still debated today. The earliest written indications of the pestilence come from contemporary figures situated in Anatolia, such as orator Aelius Aristides and historian Crepereius Calpurnianus, whose lost account of the Roman-Parthian war of the 160s is discussed by Lucian. There is evidence of an Arabian-wide epidemic in the mid-to-late 150s C.E., suggesting that the pandemic may have started earlier and closer to Egypt. Cassius Dio recounts how Avidius Cassius, a general under Lucius Verus, lost many of his soldiers to famine and disease on the journey to Syria after sacking Parthian cities in 165 C.E., aligning with the accounts suggesting Near Eastern origins for the pestilence. The pandemic reached Rome by 166 C.E. according to imperial physician Galen, who witnessed the plague in the capital and among Roman legionaries stationed in Aquileia (northeastern Italy) in 168 C.E. It subsequently spread to Gaul, the Nile delta (by 168–169 C.E. at the latest), and most other provinces of the empire, seemingly facilitated by Roman army movements.[27]

26 *SB* 1.1182 and *SB* 1.1183; *SB* 1.2099 and *SB* 1.3929; *SB* 1.5401 and *SB* 1.5395. François Blondel et al., "Mummy Labels: A Witness to the Use and Processing of Wood in Roman Egypt," *International Journal of Wood Culture*, III (2023), available at doi.org/10.1163/27723194-bja10017.

27 See Galen, *Method of Medicine*, 5.8; *idem*, *On My Own Books,* 1.16, 3.1–3; Aelius Aristides, *Orations*, 48.38–44; Lucian, *How to Write History,* 15; *P. Thmouis* 1, col. 104; Cassius Dio, *Roman History*, 71.2.4, 73.14.3–4; Herodian, *Roman History*, 1.12.1; Eutropius, *Summary of Roman History*, 8.12; *Historia Augusta*, Lucius Verus 8.1–5; Ammianus Marcellinus, *Rerum Gestarum*, 23.6.24, 13.6.24; *Historia Augusta*, Lucius Verus 8.1.1–2; Jerome, *Chronicon*, 236, 237; Orosius, *Histories against the Pagans*, 7.15.5, 7.27.7. The *Historia Augusta* (Antoninus Pius 9.4) claims that the disease destroyed "the whole land," which is corroborated by an inscription dated to the same period that details the pestilential ruin of Gawr (modern Bayt al Ahraq) on the southern Arabian side of the Red Sea coast. Robin, "Guerre et épidémie dans les royaumes d'Arabie du Sud, d'après une inscription datée (IIe s. de l'ère chrétienne)," *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres*, CXXXVI (1992), 234; Benoît Rossignol, "Le climat, les famines et la guerre: éléments du contexte de la peste antonine," in Elio Lo Cascio (ed.), *L'Impatto della Peste Antonina* (Bari, 2012), 87–122; Kyle Harper, *The Fate of Rome: Climate, Disease, and the End of an Empire* (Princeton, 2017), 99.

Although most of the written evidence suggests that the Near East was the point of origin, Calpurnianus claims that the epidemic he witnessed at Nisibis came from Aithiopia. This version is transmitted by the satirist and rhetorician Lucian, who berates Calpurnianus for plagiarizing from Thucydides' account of the Plague of Athens. Lucian notes the striking similarities in style, as well as criticizing Calpurnianus' claim that the pestilence "descended into Egypt" from Aithiopia, which is identical to Thucydides' description.[28]

Save for Calpurnianus' account, most written records referencing the Antonine Plague or epidemics during the same period imply that it originated in western Asia, although the matter is still debated. Because the pathogenic cause of this pestilence has not been confirmed, our understanding of it relies mostly on the written evidence. Galen's symptomatology, which includes fever, violent coughing, vomiting, gastrointestinal afflictions, and skin ulcers spread over the entire body, indicates that the Antonine Plague was unlikely to have been actual plague (the result of infection by the bacterium *Y. pestis*). Most scholars and medical professionals surmise that Galen's descriptions align more closely with smallpox or an ancient ancestor of smallpox caused by the human-obligate variola virus.[29]

Following this diagnostic reasoning, Harper suggested that the Antonine Plague may have spread from Africa to the Mediterranean through Indian Ocean–Red Sea trade. This idea stems from

28 Lucian, *How to Write History*, XV; Thucydides, 2.48.1–2.

29 For diagnosis based on Galen's symptomology, see Robert J. Littman and Michael L. Littman, "Galen and the Antonine Plague," *American Journal of Philology,* XCIV (1973), 243–255. For other adherents of the poxvirus theory, see Walter Scheidel, *Death on the Nile: Disease and the Demography of Roman Egypt* (Leiden, 2001), 95; Yan Zelener, "Genetic Evidence, Density Dependence and Epidemiological Models of the 'Antonine Plague,'" in Lo Cascio (ed.), *L'impatto*, 167–178; Sallares, "Ecology, Evolution, and Epidemiology," 37; Cheston B. Cunha and Burke A. Cunha, "Great Plagues of the Past and Remaining Questions," in Didier Raoult and Michel Drancourt (eds.), *Paleomicrobiology: Past Human Infections* (Berlin, 2008), 12; Harper, *Fate of Rome*, 102; McDonald, "The Antonine Crisis: Climate Change as a Trigger for Epidemiological and Economic Turmoil," in Paul Erdkamp, Joseph Manning, and Koenraad Verboven (eds.), *Climate Change and Ancient Societies in Europe and the Near East: Diversity in Collapse and Resilience* (Cham, Switzerland, 2021), 387–391. For recent challenges to this view, see Rebecca Flemming, "Galen and the Plague," in Caroline Petit (ed.), *Galen's Treatise Περὶ Ἀλυπίας (De indolentia) in Context* (Leiden, 2019), 219–244; Timothy Newfield, Ana Duggan, and Hendrik Poinar, "Smallpox in Antiquity in Doubt," *Journal of Roman Archaeology*, XXXV (2022), 1–17.

the theory that the variola virus originated in Africa. Molecular microbiologists Babkin and Babkina conducted phylogenetic analyses that suggest new poxviruses VARV (the earliest strain of smallpox), CMLV (camelpox), and TATV (taterapox), emerged in Africa, having diverged from the same ancestor around 3,300–3,400 years ago. They say that the introduction of camels to Africa may have triggered the divergence of these poxviruses from a common ancestor. Because a portion of central Africa (including ancient Aithiopia) is the lone habitat of the naked-soled gerbil, the only known host of taterapox, Babkin and Babkina concluded that this geographic region could be the place of the poxvirus divergences, leading to Harper's suggestion that it was the source of the pandemic nearly two millennia later.[30]

There are two problems with Babkin and Babkina's poxvirus-divergence theory. The first is that taterapox has been isolated only once from a naked-soled gerbil, and there has been little investigation since as to whether they are in fact the natural hosts of taterapox or if the poxvirus exists in similar species. Second, Babkin and Babkina rely on Bulliet's hypothetical conclusions regarding the introduction of camels from Arabia to Africa around 1500–1300 B.C.E. Newer work indicates that the dromedary camel was probably domesticated in Arabia around 1,000 B.C.E. and not introduced to Africa until the first millennium B.C.E. Evidence of camel domestication occurring after the viral divergences, undermines the plausibility of Babkin and Babkina's theory and their suggested divergence timeframe.[31]

The phylogenetic chronologies advanced by Babkin and Babkina and other molecular microbiologists are largely based on evolutionary projections and molecular clock modeling that scrutinize genomic differences between retrieved pathogenic

30 Igor V. Babkin and Irina N. Babkina, "A Retrospective Study of the Orthopoxvirus Molecular Evolution," *Infection, Genetics and Evolution*, XII (2012), 1597–1604; *idem*, "The Origin of the Variola Virus," *Viruses*, VII (2015), 1100–1112; Harper, *Fate of Rome*, 91–98.

31 Bernard Lourie et al., "Isolation of Poxvirus from an African Rodent," *Journal of Infectious Diseases,* CXXXV (1975), 677–681. Richard Bulleit, *The Camel and the Wheel* (New York, 1975), 38–56. The earliest physical evidence of the camel in northeastern Africa dates to the first few centuries of the first millennium B.C.E. Peter Rowley-Conwy, "The Camel in the Nile Valley: New Radiocarbon Accelerator (AMS) Dates from Qaṣr Ibrîm," *Journal of Egyptian Archaeology*, LXXIV (1988); Faisal Almathen et al. "Ancient and Modern DNA Reveal Dynamics of Domestication and Cross-continental Dispersal of the Dromedary," *Proceedings of the National Academy of Sciences*, CXIII (2016), 6707–6712.

strains. These predictions are not definitive and can change when new strains are recovered. As such, the certainty of Babkin and Babkina's conclusions for VARV is subject to potential revisions based on future findings, which could strengthen or further undermine their theory. It is important to distinguish between the pathogen's ultimate origin (where it originated) and its proximate origin (where it focalized and spread from before resulting in a wide-scale pestilence). Although theories suggesting Africa as the origin of the variola virus are not indisputable based on current evidence, it is possible that an ancient poxvirus, which originated in Africa long before the Common Era, was the pathogen responsible for the Antonine pandemic. In this case, even if the virus originated in Africa, it could have spread to western Asia between the late Bronze Age and antiquity. The lack of conclusive evidence does not rule out Africa as the origin of the Antonine Plague, and scientific understanding of the pandemic's contours is still evolving.

Indeed, without scientific confirmation, any discussion of ancient strains of variola virus as the cause of the Antonine pandemic is conjectural. Newfield, Duggan, and Poinar recently emphasized the highly speculative nature of retrospectively diagnosing the second-century pandemic as an ancestor of smallpox, given that we do not know how ancient strains of VARV manifested in humans. With that said, it is possible that the ancestor of modern smallpox (mVARV) caused similar symptoms and mortality. Genomic work led by Mühlemann suggests that the newly detected strain aVARV, so far dated to the early medieval period, and mVARV were not vastly different, though their "gene content" shows "great contrast." It is conceivable that their common ancestor was not very different either. Thus, the possibility of an ancient poxvirus as the cause of the second-century pestilence remains open for consideration.[32]

32 Newfield, Duggan, and Poinar, "Smallpox in Antiquity," 1–17; Mühlemann et al., "Diverse Variola Virus Strains," 2–5. Barbara Mühlemann et al., "Diverse Variola Virus (Smallpox) Strains," *Science*, CCCLXIX (2020). Mühlemann and collaborators suggest that an extinct Viking Age strain of poxvirus (aVARV) had existed by the seventh century C.E., and they propose that this strain may have had a broader host range, potentially infecting multiple mammals, than mVARV. This possibly explains accounts from Aristides (*Orations* 48.38–44) and Herodian (*Roman History*, 1.12.1) that both humans and livestock were infected by the same disease—an idea broached by Green in 2019.

Setting aside the pathogenic cause of the Antonine Plague, most written evidence points to western Asia as the proximate origin of the pandemic. Three contemporary authors discuss disease outbreaks in the Near East around the proposed start date of the pandemic, and two late-Roman writers specifically claim that it originated in that region. The Arabian pestilence of the mid-to-late 150s C.E.—mentioned in the *Historia Augusta* and confirmed in an inscription at Gawr/Bayt al Ahraq (Fig. 2)—suggests that the Antonine Plague may have started earlier and closer to southwestern Asia than previously thought. Additionally, archaeological material from Egypt's Eastern Desert and Red Sea coast demonstrates a decline in activity in the late second and third centuries C.E., beginning soon after the Arabian pestilence and coinciding with the Antonine Plague. Considering the dynamic commercial network connecting Mediterranean and Indian Ocean societies—facilitated by Roman Egypt—it is unlikely that a large-scale epidemic near the southern coast of Arabia was an isolated event. Although we have no way of directly linking the Arabian pestilence to the Antonine Plague, the chronological consistencies between the Arabian disease event, the downturn of the Eastern Desert/Red Sea coast, and the Antonine Plague suggest that Egypt may have been the first Roman boundary breached by the pathogen of the pandemic. Is it possible that Calpurnianus did not plagiarize Thucydides regarding the pandemic's origin and that Harper was indeed on the right track?[33]

Second-century papyri do not help us to determine whether the Antonine Plague began in northeast Africa, but they do suggest that the plague's impact in Egypt was significant. One direct mention of disease appears in an administrative report, which notes a pestilence affecting the village of Kerkenouphis in the Mendesian Nome of the Nile delta in 168–69 C.E., three or four years after the presumed initial outbreak in the Near East. The wording ("the pestilential situation") suggests an impact wider than Kerkenouphis, possibly beginning earlier and elsewhere in Egypt. Although this is the only reference to pestilence in Egypt during

33 Aelius Aristides, *Orations*, 48.38–44; Lucian, *How to Write History*, 15; Cassius Dio, *Roman History*, 72.2.4; *Historia Augusta*, Antoninus Pius 9.4; Ammianus Marcellinus, *Rerum Gestarum*, 23.6.24. McDonald, "Downturn of Egypt's Eastern Desert."

this period, silence from the papyri does not equate to absence of the pandemic.[34]

The papyri provide potential indirect evidence of the Antonine Plague's impact in Egypt, which might shed light on its origin. Rathbone's population counts from the Fayum Oasis and the Nile delta suggest that the pestilence had a devastating effect on Lower and Middle Egypt. For example, the population of Karanis fell from 3,600 to 2,300 between the 150s and the 170s C.E., and in Soknopaiou Nesos, 78 of 244 males registered in late 178 C.E. seem to have died by early 179 C.E. A papyrus from Arsinoe details a man's three relatives dying within the same month in 175/6 C.E. in the district of Heracleides. Similarly, papyri-based data demonstrate that depopulation occurred widely in the Mendesian nome of the Nile delta in the same period. Though the cause of depopulation is open to debate, these findings do suggest that the Fayum and the delta were struck by the pestilence in the mid-to-late 170s.[35]

The papyrological evidence demonstrates population losses and economic stagnation in late-second-century Egypt, but research suggests other factors, such as socio-political turmoil

34 *P. Thmouis* 1, col. 104, 1.16; see also Katherine Blouin, *Triangular Landscapes: Environment, Society, and the State in the Nile Delta under Roman Rule* (Oxford, 2014), 246–247.

35 Dominic Rathbone, "Villages, Land and Population in Graeco-Roman Egypt," *Cambridge Classical Journal*, XXXVI (1990), 114–119, 124–135. *P.Mich.* 4.1.223–225, 6.372; Arthur E. R. Boak, "The Population of Roman and Byzantine Karanis," *Historia: Zeitschrift für Alte Geschichte*, IV (1955), 157–162; Bagnall, "Agricultural Productivity and Taxation in Later Roman Egypt," *Transactions of the American Philological Association*, CXV (1985), 289–308; Rathbone, "Villages, Land and Population," 130–134. *SB* 16.12816 = *SPP* 22.93; Deborah Hobson, "Agricultural Land and Economic Life in Soknopaiou Nesos," *Bulletin of the American Society of Papyrologists*, XXI (1984), 89–109; *P. Thmouis* 1.104; Rathbone, "Villages, Land and Population," 134–137. *BGU* 1.79 = *C.Pap.Gr.* 2.55. For more on the ongoing discussion about the impact of the Antonine Plague through papyrological evaluations and economic models, see Duncan-Jones, "Impact of the Antonine Plague"; Bagnall, "*P. Oxy.* 4527 and the Antonine Plague in Egypt: Death or Flight?" *Journal of Roman Archaeology*, XIII (2000), 288–292; Scheidel, "A Model of Demographic and Economic Change in Roman Egypt after the Antonine Plague," *Journal of Roman Archaeology*, XV (2002), 15; Bagnall, "The Effects of Plague: Model and Evidence," *Journal of Roman Archaeology*, XV (2002), 114–120; James Greenberg, "Plagued by Doubt: Reconsidering the Impact of a Mortality Crisis in the 2nd c. A.D.," *Journal of Roman Archaeology*, XVI (2003), 413–425; Christer Bruun, "The Antonine Plague in Rome and Ostia," *Journal of Roman Archaeology*, XVI (2003), 426–434; Scheidel, "Roman Wellbeing and the Economic Consequences of the Antonine Plague," in Lo Cascio (ed.), *L'Impatto*, 265–295; Peter van Minnen, "*P. Oxy.* LXVI 4527 and the Antonine Plague in the Fayyum," *Zeitschrift für Papyrologie und Epigraphik*, CXXXV (2001), 175–177; Kyle Harper, "People, Plagues, and Prices in the Roman World: The Evidence from Egypt," *Journal of Economic History*, LXXV (2016), 803–839.

and climate/environmental change, also affected the province. Although the Antonine pestilence was most likely impactful, it was probably not the sole cause of the observed losses, as some documents list "flight" and "ruination" more than "death" for men no longer present in villages. Failed Nile floods, a changing agrarian landscape and uprisings throughout the delta (probably the result of unproductive land continuing to be taxed at the same rate), most likely contributed to the decline. The papyri do not preclude the idea that the Antonine Plague struck Egypt first or that it had significant effects on Egyptian economy and society, all of which remains possible; yet trends gleaned from the papyrological evidence cannot alone be used as evidence for the origin or impact of the pandemic.[36]

AN EPIDEMIC IN AITHIOPIA UNDER SEPTIMIUS SEVERUS During Emperor Septimius Severus' visit to Egypt in the late second century C.E., a pestilence in Aithiopia prevented his party from journeying beyond the first Nile cataract (Fig. 1). The outbreak appears to have been limited geographically, affecting areas near the border of Egypt and Aithiopia, or Severus would not have travelled widely across Egypt. There is no information on the nature of this pestilence, aside from it having been large enough to deter the imperial convoy. Though we have no records that it spread northward into Roman Egypt, this epidemic represents the first reliably documented pestilence near the Nile valley lands that joined Egypt and Aithiopia in the Classical period.[37]

THE PLAGUE OF CYPRIAN Another plague that is said to have originated in Aithiopia and spread via Egypt to the Mediterranean is the Plague of Cyprian of the mid-third century C.E. Harper, in a series of articles and a monograph, gathered the evidence for this pestilence, which had essentially hitherto gone unnoticed in scholarship. Harper argues that the pestilence entered the Roman Empire in Egypt from Aithiopia in winter 248/9 C.E.

36 Andrew Wilson, "The Mediterranean Environment in Ancient History: Perspectives and Prospects," in William V. Harris (ed.), *The Ancient Mediterranean Environment between Science and History* (Leiden, 2013), 265; Blouin, *Triangular Landscapes*, 246–247, 295–297; Colin Elliot, "The Antonine Plague, Climate Change and Local Violence in Roman Egypt," *Past & Present*, 231 (2016), 4–8.
37 Cassius Dio, *Roman History*, 76.13.

and from there spread west, prompting Decius to issue an edict in late 249 C.E. requiring sacrifices to the imperial gods and to the emperor's well-being. Huebner's critical response to Harper's arguments suggests that the disease entered the Roman Empire through Gothic invasions on the Danube rather than originating in Aithiopia, highlighting the influence of later Byzantine chroniclers who may have incorporated elements of disease origins from Thucydides in their accounts of the pandemic.[38]

Nevertheless, it is undisputed that this plague reached Egypt. The letters of the Alexandrian bishop Dionysius, which are believed to have been written in the years before his death in 264/5 C.E. and are cited by Eusebius, discuss continuous pestilences of unknown origin and tremendous loss of life in Alexandria. This pandemic is also mentioned by Cyprian of Carthage (the plague's namesake) and his biographer Pontius of Carthage, as well as Porphyry, Zosimus, Eutropius, Aurelius Victor, the *Historia Augusta*, *Epitome de Caesaribus*, the *Chronicle of Eusebius* in its Armenian and Latin translation, Evagrius Scholasticus, Orosius, Peter the Patrician, and the later Byzantine chroniclers in 262 C.E.[39]

Following the initial outbreak in late summer of 251 C.E.—Huebner's revision of Harper's dating—the pestilence persisted for nearly twenty years, spreading throughout many regions of the empire, including Illyricum, Greece, the major harbors of the Mediterranean (Rome, Carthage, and Alexandria), and the Roman military headquarters in Asia Minor and Osrhoene. Rome, Athens, Alexandria, and the Balkan fronts were said to have been struck several times by the disease over these two decades. According to Zosimus, more than half of infected individuals died, and the *Historia Augusta* mentions a daily death toll of around 5,000 in Rome and in some Greek cities in 262 C.E.[40]

38 Harper, "Pandemics and Passages to Late Antiquity"; *idem*, "The Environmental Fall of the Roman Empire," *Daedalus*, CXLV (2016), 101–111; *idem*, "People, Plagues, and Prices"; *idem*, "Another Eyewitness to the Plague Described by Cyprian, with Notes on the 'Persecution of Decius,'" *Journal of Roman Archaeology*, XXIX (2016), 473–476; *idem*, *Fate of Rome*, 119–159. Huebner, "The 'Plague of Cyprian': A Revised View of the Origin and Spread of a 3rd-c. C.E. Pandemic," *Journal of Roman Archaeology*, XXXIV (2021), 161.

39 Eusebius (trans. Paul L. Maier), *The Church History* (Grand Rapids, 1999), 7.21.8, 7.11.24. For references, see Huebner, "The 'Plague of Cyprian,'" 161.

40 Zosimus 1.36.1–2; *Historia Augusta*, Gallienus 5.2–5; Huebner, "The 'Plague of Cyprian," passim.

Recent research has shown that this account, as previously assumed, is indeed most likely reflecting the Athenian historian Dexippus' perspective from mainland Greece. Scholars deciphered eighteen new lines of the *Scythica Vindobonensia*, a palimpsest that probably belongs to the lost *Scythica* of Dexippus. These lines report a Scythian invasion of Thrace, Macedonia, and Greece, which likely occurred in 254 or the early 260s. The text, probably written by Dexippus, also contains a reference to an earthquake, most likely in Rome, and an account of a devastating plague in Rome and most of Greece. Dexippus stresses the lethality of the disease and the devastation caused by this particular occurrence and speaks of numerous recurrences of the pestilence, which seized the population in short intervals. The Scythians took it as an opportunity to cross the Istros with ships and invade Thrace and Macedonia, devastating the entire country.[41]

Cyprian describes the symptoms of this highly contagious and acute disease as including pain in the eyes, intense fever, ailing limbs, general weakness, diarrhea, inflamed throat, vomiting, and bloodshot eyes. In the long term, the disease could lead to putrefied limbs, limping, and loss of hearing and vision. The symptomatology is reminiscent of Thucydides' description of the Plague of Athens, but Cyprian does not mention coughing, convulsions, or skin rashes. Harper convincingly notes that the sermon's timing, delivered amid an outbreak, lends credibility to Cyprian's symptomatology.[42]

The causative agent of the Plague of Cyprian remains unidentified, but based on Cyprian's symptomatology, Harper proposed that it may have been a viral hemorrhagic fever like Ebola. However, definitive confirmation awaits the isolation of ancient DNA (if the pathogen were DNA based) from skeletal remains that match the chronology of the pestilence—a difficult feat considering that limited traces are left in the skeleton by rapidly fatal pathogens.

41 Gunther Martin and Jana Grusková, "Facing the Plague and the Goths: A New Passage from the *Scythica Vindobonensia* (*Codex Vindobonensis hist. gr.* 73, fol. 192r, lines 13–30)," *Greek, Roman, and Byzantine Studies*, LXII (2022), 438–493. Zosimus. 1.36; *Historia Augusta*, Gallienus, 5.2–5. For the number of people dying of the Antonine plague, see Cassius Dio, *Roman History*, 72.14.3–4. Cf. Christopher P. Jones, "Dexippus and the Third-Century Plague," in Fritz Mitthof, Martin, and Grusková (eds.), *Empire in Crisis: Gothic Invasions and Roman Historiography* (Vienna, 2020), 160; Huebner, "The 'Plague of Cyprian,'" 12.

42 Zosimus 1.26.2; 1.37.3; Cyprian, *De Mortalitate*, 8, 14. Harper, "Pandemics and Passages," 241; Huebner, "The 'Plague of Cyprian.'"

Huebner suggested that the huge necropolis of the military camp at Viminacium in Upper Moesia, which contains more than 13,000 graves and was the headquarters of the Roman army during the Gothic wars, might be a suitable place to base genomic work.[43]

According to Eusebius, Alexandria experienced several distinct occurrences of the pestilence in 253, 258/9, and 262/3 C.E. So far, no papyrus mentioning disease from the Egyptian hinterland can be dated exactly to the time of the Plague of Cyprian, even though papyrological documentation for the third century is dense and continuous. The private letters in which illnesses are mentioned do not bear dates and can only be roughly dated based on paleography. Following a period of silence, there are several references to epidemic disease in papyri from the third century, which may be pure coincidence, but could also demonstrate a heavier disease burden.[44]

In *P. Oxy.* 14.1666—a papyrus letter dated to the third century C.E. based on paleography—a man, Pausanias, writes to his brother Heracleides about having heard that a pestilence was spreading through the region of Oxyrhynchus. While traveling down the Nile from Upper Egypt to Alexandria, Pausanias refrained from visiting his brother in Oxyrhynchus due to rumors of the epidemic. The letter suggests that the outbreak was limited to the region of Oxyrhynchus, as Pausanias does not mention disease afflicting cities or towns south of Oxyrhynchus.[45]

Another papyrus letter found in Oxyrhynchus (*PSI* 4.299) recounts a severe disease that befell several members of the same family. The author of the letter, Titianus, reports that he had been afflicted with a severe sickness to the point that he was unable to move and, even though he recovered, was still suffering from infected, purulent eyes and pain in all parts of his body. Titianus' father, mother, and all of the children of the family also became infected but eventually recovered. This outbreak may be connected to the Plague of Cyprian; it also could be linked to the disease outbreak in Oxyrhynchus mentioned above. A third papyrus letter (*P. Strasb.* 1.73), of unknown Egyptian provenance, tells of

43 Harper, "Pandemics and Passages," 247; McDonald, "Climate Change and Major Plagues in the Roman Period," unpub. D.Phil. thesis (Univ. of Oxford, 2020), 182–188; Huebner, "The 'Plague of Cyprian,'" 20–21.

44 Huebner, "The 'Plague of Cyprian.'"

45 *P. Oxy.* 14.1666, l. 19–20.

"a major illness" that afflicted an entire family, resulting in the death of a small boy, and infecting the author's foot. The symptoms related by these authors parallel those in Cyprian's description—fever, pain in the eyes, and putrefied limbs.[46]

Mummy labels for a pair of brothers—Petetriphis and Peteminis—from Psonis in the Panopolite nome in Upper Egypt have been dated to between 225 and 275 C.E. The brothers probably died around the same time, perhaps on the same day, as their mummy labels were produced from the same piece of wood, confirmed by dendrochronological analysis of the wood's ring-growth pattern. The death of two family members close in time may be indicative of an epidemic event, like that mentioned in the family letters discussed above.[47]

Although at least two papyri dating to the third century C.E. record symptoms resembling the disease described by Cyprian in *De mortalitate* and could be demonstrating that it spread in Africa beyond Carthage and Alexandria, they cannot be firmly linked to the Plague of Cyprian or indicate its origin or spread. The letters of the Alexandrian bishop Dionysius mention the pandemic as a devastating event, but there is a lack of evidence for a widespread and paralyzing pandemic in the documentary sources from Roman Egypt, including those in the archive of Heroninus, the largest collection of papyri from the time.[48]

Moreover, establishing a causal link between the pandemic and the empire's broader third-century crisis is challenging, despite the temporal correlation. That the Palmyrenes were able to annex Egypt in 270 was probably in large part due to a weakened, disorganized military and administration rather than the pandemic. Likewise, there are too few data to determine whether there were in fact substantial wage increases and/or land-price reductions as a result of pandemic-related population losses, as Harper suggested.

46 Isabella Andorlini, "Note di lettura ed interpretazione a *PSI* IV 299: un caso di tracoma," in Franco Crevatin and Gennaro Tedeschi (eds.), *Scrivere Leggere Interpretare: studi di antichità in onore di Sergio Daris* (Trieste, 2005), 6–11. Cf. Cyprian, *De Mortalitate*, 8, 14.

47 *SB* 1.2099; *SB* 1.3929. For a discussion of the mummy labels, see Blondel et al., "Mummy Labels."

48 The abandonment of certain villages in the Fayum can be attributed to factors such as water shortage rather than the Cyprianic Plague. See Huebner, "Climate Change in the Breadbasket of the Roman Empire: Explaining the Decline of the Fayum Villages in the Third Century CE," *Studies in Late Antiquity*, IV (2020), 486–518.

It is also uncertain whether the pandemic was to blame for the acute inflation occurring around 274 C.E.—Aurelian's coinage reform undoubtedly played the largest role.[49]

Like the Antonine Plague a century earlier, the pathogenic cause of the Cyprianic Plague remains unidentified. Although the written evidence implies that the disease was highly contagious and may have resembled a Viral Hemorrhagic Fever, further research and molecular investigations are needed to provide confirmation.[50]

THE FOURTH AND FIFTH CENTURIES C.E. In the subsequent two centuries, reports of disease in Egypt are scarce, and for the broader Roman Empire, only local epidemics are attested, which could be due to the nature of the sources. Eusebius describes an epidemic of "anthrax" in the eastern empire during the reign of the emperor Maximinus II Daia (308–313), which was characterized by ulcers and eye infections, leading to blindness in some. Eusebius does not mention specific cities or regions, but he was probably referring to most of Syria, possibly extending to other regions of the Diocese of Oriens, which included Egypt. Based on the symptoms, this disease was most likely not our modern conception of anthrax, an infection caused by the spores of the bacterium *Bacillus anthracis*, but instead possibly a poxvirus. It may have been a recurrence of the pathogen responsible for the Antonine Plague or an early outbreak of mVARV or aVARV. Kennedy and DeVore recently questioned the veracity of Eusebius' plague narrative, proposing that he exaggerated a local epidemic to polemize against Christian persecutors, particularly Maximinus Daia.[51]

49 Harper, "People, Plagues, and Prices"; Rathbone, "Prices and Price Formation in Roman Egypt," in Jean Andreau, Pierre Briant, and Raymond Descat (eds.), *Économie antique. Prix et formation des prix dans les économies antiques* (Saint-Bertrand-de-Commings, 1997), 183–124; Christopher Howgego et al., "Coinage and the Roman Economy in the Antonine Period: The View from Egypt," Oxford Roman Economy Project: Working Papers, 2010, available at oxrep.classics.ox.ac.uk/docs/Howgego2010.pdf (accessed May 19, 2023).

50 On diagnosing the Plague of Cyprian, see Harper, "Rethinking the Plague of c. 249–70"; *idem*, *Fate of Rome*, 142–145.

51 Eusebius, *The Church History*, 9.8. For a discussion on VARV, see Mühlemann et al. "Diverse Variola Virus (Smallpox) Strains"; Newfield, Duggan, and Poinar, "Smallpox in Antiquity in Doubt"; Scott Kennedy and David DeVore, "The Famine and Plague of Maximinus (311–12): Between Ekphrasis, Polemic, and Historical Reality in Eusebius's Ecclesiastical History," *Journal of Late Antiquity*, XVI (2023), 27–53.

The Vita of Pachomius recounts a pestilence in the monasteries of the Thebaid in Upper Egypt in 346 C.E. The disease, which afflicted every Pachomian monastery, was highly contagious and resulted in numerous deaths among the monks. Symptoms included fever, skin discoloration, bloodshot eyes, increasing respiratory distress, and often death. Abba Pachomios, the founder of the monastic order, also eventually fell ill, though, unlike the others who died quickly, he fought it for forty days before dying, during which time he lost considerable body weight and suffered "inflammation" of the heart and eyes. Although editors of his Vita identify the pestilence as "the plague," the symptoms, especially progressive shortness of breath, make it unlikely to have been true plague unless it was in its pneumonic form. The symptoms and its rapid rate of transmission hint at a viral respiratory infection.[52]

Toward the late fourth century, a papyrus letter from Lykopolis in middle Egypt refers to an epidemic that may have been the same disease as that in Thebaid. The letter tells of a young recruit who spent all his money on doctor's bills during a pestilence. This outbreak seems to have been preceded by food shortages, as the young man complains that he and his fellow recruits were ravaged by hunger. Aside from this letter, there are no other references to disease, let alone epidemics, in Egyptian papyri for the remainder of Roman-Byzantine rule in Egypt.[53]

THE JUSTINIANIC PLAGUE Although the evidence does not convincingly demonstrate that the Antonine and Cyprianic plagues reached the Mediterranean by passing through Egypt, a strong case can be made that the Justinianic Plague did. The initial wave of the plague occurred between 541 and 544 C.E., and as many as seventeen recurrences through the mid-eighth century are cited by modern historians.[54]

52 Armand Veilleux, *The Life of Saint Pachomius and His Disciples* (Kalamazoo, 1980), 175, 216, 378–379.

53 Cf. Casanova, "Epidemie e fame," 180 with n. 81. *P. Lond.* 3.982, l.7–9.

54 Jean-Noël Biraben and Jacques Le Goff, "La Peste dans le Haut Moyen Age 1," *Annales. Histoire, Sciences Sociales* XIV (Cambridge, 1969), 1484–1510; Dionysios Stathakopoulos, *Famine and Pestilence in the Late Roman and Early Byzantine Empire: A Systematic Survey of Subsistence Crises and Epidemics* (Aldershot, 2004), 113–122; *idem*, "Crime and Punishment," in Little (ed.), *End of Antiquity*, 100–105.

Historical accounts indicate that the plague's initial wave began in northeastern Africa, with Procopius saying that it first reached the Byzantine world at Pelusium in Egypt around the middle of 541. It then spread to Alexandria and Palestine by autumn. By early 542, it had reached Syria, Anatolia, and Constantinople. Written and epigraphical evidence suggest that North Africa and Sicily, respectively, were struck in 542, and written evidence puts the plague in Italy, Illyricum, and Gaul by 543. Groundbreaking molecular investigations using ancient DNA have provided genetic data that identified early occurrences of the pandemic as far northwest as the British Isles.[55]

That study and similar research entailed ancient DNA analyses on early medieval skeletal remains from various locations in central and western Europe. The studies confirm that *Y. pestis*, the bacterial agent of plague, was the disease responsible for the Justinianic

55 For Egypt and Palestine, see Procopius, *History of the Wars,* 2.22.6; John of Ephesus preserved in *Chronique de Michel le Syrien*, 2.235, 2.240, 4.305, 4.308; Witold Witakowski, *Pseudo-Dionysius of Tel-Mahre* (Liverpool, 1997), 74–93; John Malalas, *Chronographia*, 18.92; *Chronicle of Seert*, 182 (90)–185 (93); Carol Glucker, *The City of Gaza in the Roman and Byzantine Periods* (Oxford, 1987), 124–126; George E. Kirk and Bradford C. Welles, "Inscriptions" in Harris Dunscombe Colt and T. J. Colin Baly (eds.), *Excavations at Nessana: (Auja Hafir, Palestine)* (Jerusalem, 1962), 168, 179–181; Yoram Tsafrir, *Excavations at Rehovot-in-the-Negev* (Jerusalem, 1988), 161; Avraham Negev, "The Greek Inscriptions from Avdat (Oboda)," *Studii Biblici Franciscani Liber Annuus Jérusalem*, XVIII (1978), 107; McDonald, "The Justinianic Plague in the Late Antique Negev." For Syria and Anatolia, see Witakowski, *Pseudo-Dionysius of Tel Mahrē*, 74–84. Symeon Stylites the Younger, *Vita*, 69; Evagrius, *Ecclesiastical History*, 4.29; Lennart Rydén, *Das Leben des Heiligen Narren Symeon von Leontios von Neapolis* (Stockholm, 1963), 151; Nicholas of Sion, *Vita*, 52. For Constantinople, see Procopius, *History of the Wars*, 2.22.9, 2.23.1–3, 18–19; Witakowski, *Pseudo-Dionysius of Tel Mahrē*, 84–86; John Malalas, *Chronographia*, 18.92; Theophanes, *Chronographia*, AM 6034. For North Africa and Sicily, see Victor of Tunnuna, *Chronicon*, 93; Corippus, *Iohannis*, 3.343–390; Gilles Bransbourg, Alain Bresson, and McDonald, "The First Plague Pandemic in Africa," *Human Ecology* (forthcoming); Giacomo Manganaro, *Byzantina Siciliae* (Rome, 2001), 133. For Italy and Illyricum, see Marcellinus Comes, *Chronicon*, ad annum 543, 107; Theodor Mommsen (ed.), *Gestorum Pontificum Romanorum* (Berlin, 1898), I, 152; Giovanni B. De Rossi, *Inscriptiones Christianae Urbis Romae Septimo Saeculo Antiquiores* (Rome, 1888), I, 1452, II, 4287, 4289, 5087, 5088, 20839, VII, 17624; Harper, "The First Plague Pandemic in Italy," *Speculum*, XCVIII (2023). For Gaul, see Gregory of Tours, *History of the Franks*, 4.5; *idem*, *Life of the Fathers*, 6.6. For Britain, see Marcel Keller et al., "Ancient *Yersinia pestis* Genomes from across Western Europe Reveal Early Diversification during the First Pandemic (541–750)," *Proceedings of the National Academy of Sciences*, CXVI (2019), available at doi.org/10.1073/pnas.1820447116. For a challenge to our understanding of the Justinianic Plague's chronology and the sources we rely on for it, see Newfield, "One Plague for Another? Interdisciplinary Shortcomings in Plague Studies and the Place of the Black Death in Histories of the Justinianic Plague," *Studies in Late Antiquity*, VI (2022), 600–602.

pandemic. The classic model of plague transmission, established by Paul-Louis Simond only in the late nineteenth century, identifies rodents as the typical natural reservoirs/carriers of *Y. pestis* and insect vectors, usually rat fleas, as the bridge of transmission between rodents and humans. Although rodents and their fleas are the most commonly associated carriers and most efficient vectors of plague, *Y. pestis* can infect various mammals, such as dogs, cats, and camels, and insects other than rat fleas, such as lice, can transmit the bacterium (albeit with far less competency).[56]

Genomic analyses indicate that 0.ANT, the ancestor of the First Plague Pandemic lineage 0.ANT4, emerged in Central Asia, specifically the Tian Shan region of Kyrgyzstan and northwestern China. Strains linked to the First Plague Pandemic, reconstructed from skeletal remains from central Europe, Spain, and Britain, shared a common ancestor in the first half of the first millennium C.E. The exact location of the emergence of these strains and the

56 Genetic evidence: Michaela Harbeck et al., "*Yersinia pestis* DNA from Skeletal Remains from the 6th Century AD Reveals Insights into Justinianic Plague," *PLoS Pathog,* IX (2013), available at https://doi.org/10.1371/journal.ppat.1003349; David M. Wagner et al., "*Yersinia Pestis* and the Plague of Justinian," *Lancet Infectious Diseases*, XIV (2014), 319–326; Michal Feldman et al., "A High-Coverage *Yersinia pestis* Genome from a Sixth-Century Justinianic Plague Victim," *Molecular Biology and Evolution*, XXXIII (2016), 2911–2923; Keller et al., "Ancient *Yersinia pestis* Genomes," 12363–12372. John of Ephesus discusses plague affecting other mammals alongside rats; Witakowski, *Pseudo-Dionysius of Tel Mahrē*, 78. On rodents and plague, see Robert Pollitzer, "Hosts of Infection," *Bulletin of the World Health Organization* (Geneva, 1952); David T. Dennis et al., *Plague Manual: Epidemiology, Distribution, Surveillance and Control, World Health Organization* (Geneva, 1999); "Ecology and Transmission," Centers for Disease Control and Prevention, updated July 31, 2019, www.cdc.gov/plague/transmission/index.html; McDonald, "Climate Change and Major Plagues," 253–256. For insect vectors of *Y. pestis*, see Frédérique Audoin-Rouzeau, *Les chemins de la peste: Le rat, la puce et l'homme* (Rennes, 2003); Joseph B. Hinnebsuch, Clayton O. Jarrett, and David M. Bland, "'Fleaing' the Plague: Adaptations of *Yersinia pestis* to Its Insect Vector that Lead to Transmission," *Annual Review of Microbiology*, LXXI (2017), 215–232; McDonald, "Climate Change and Major Plagues," 256–260; Katherine Dean et al., "Human Ectoparasites and the Spread of Plague in Europe during the Second Pandemic," *Proceedings of the National Academy of Sciences*, CXV (2018), 1304–1309; Adélaïde Miarinjara et al., "Poor Vector Competence of the Human Flea, *Pulex irritans*, to Transmit *Yersinia pestis*," *Parasites & Vectors*, XIV (2021), 1–15. For rodents and their fleas entering plague historiography, see Katherine Royer, "The Blind Men and the Elephant: Imperial Medicine, Medieval Historians and the Role of Rats in the Historiography of Plague," in Poonam Bala (ed.), *Medicine and Colonialism* (London, 2015), 113–124.

immediate ancestor (all part of the 0.ANT4 lineage) remains unknown.[57]

The aDNA studies led by Keller did not reveal the pandemic's proximate origin, and this research refutes suggestions that the bacterium spread through the southern steppe following Hunnic expansion. Adding further ambiguity, genomic analyses make clear that the terminal branch of the Edix Hill genome in Britain predates diversification of the lineages in mainland Europe. Some speculate that *Y. pestis* was already circulating in the Mediterranean region before the documented outbreak at Pelusium, the bacterium possibly not having caused notable epidemics until 541.[58]

Trade, migration, and warfare likely facilitated the spread of *Y. pestis* from Central Asia to the Mediterranean. Rodents or insects carrying the bacterium traveled with humans, introducing it to new rodent populations and potentially other mammals over the course of decades to centuries. The bacterium may have reached the Mediterranean more quickly, as suggested by a recent study that proposed a rapid westward dispersal of *Y. pestis* during the Second Plague Pandemic. There are multiple scenarios for the establishment of plague foci before 541. Possible routes from proximate foci toward the Mediterranean include via ships from South

57 On *Y. pestis*-strain origins, see Spyrou et al., "3800-Year-Old *Yersinia pestis* Genomes"; Galina Eroshenko et al., "*Yersinia pestis* Strains of Ancient Phylogenetic Branch 0.ANT Are Widely Spread in the High-Mountain Plague Foci of Kyrgyzstan," *PloS ONE*, XII (2017), e0187230; Katherine Eaton et al., "Plagued by a Cryptic Clock: Insight and Issues from the Global Phylogeny of *Yersinia pestis*," *Communications Biology*, VI (2023), 23 demonstrated via new estimation methods that strains associated with the First Plague Pandemic lineage (0.ANT4) "shared a common ancestor between 272 and 465 C.E." Green, "Putting Africa on the Black Death Map," 11–12; *idem*, "When Numbers Don't Count: Changing Perspectives on the Justinianic Plague," *Eidolon*, November 18, 2019, eidolon.pub/when-numbers-dont-count-56a2b3c3d07.

58 On the proximate origin of the Justinianic Plague, see Damgaard et al., "137 Ancient Human Genomes from Across the Eurasian Steppes," *Nature*, DLVII (2018), 369–374; Keller et al., "Ancient *Yersinia pestis* Genomes"; Keller et al., "Ancient *Yersinia pestis* Genomes Provide No Evidence for the Origins or Spread of the Justinianic Plague," *bioRxiv* (2019). For more on the Edix Hill evidence, see Sarris, "New Approaches to the 'Plague of Justinian,'" *Past & Present*, 254 (2022), 320–321.

Asia, East Africa, or southern Arabia, as well as overland through western Asia.[59]

Given *Y. pestis*' ultimate origin in Central Asia, the bacterium must have progressed from there to the locations of the earliest reported plague outbreaks in northeastern Africa. Sarris argued that it is unlikely the Justinianic Plague strain emerged in Central Asia and spread westward overland directly to the Mediterranean, since the evidence implies plague struck Byzantium before Persia and because there are no references to bubonic plague in Chinese sources until the seventh century. Pfister suggests that there are potential references to plague in ancient and early medieval Chinese sources, challenging the idea that plague did not affect East Asia in the sixth century or earlier. But the overland caravan route through Mesopotamia was unstable just before the pandemic due to the Persian invasions of Syria, which probably redirected trade traffic to the seas. Moreover, genetic evidence shows only one lineage diversifying just before the oldest genomes, and if there were an "open corridor" between Central Asia and the Mediterranean, we would expect multiple lineages to have reached Europe and/or deep splits in the clade of the bacterium's phylogeny.[60]

Written evidence supports the notion that the bacterium probably did not spread overland through western Asia. Accounts of the plague reaching Byzantium before Persia, the multiple contemporary reports of its origins in northeastern Africa or southern Arabia, and the general direction and chronology in which accounts of plague occur, radiating northward from Egypt, all provide strong indications. The written evidence suggests a sustained route of transmission between Central Asia and South Asia, with *Y. pestis* subsequently reaching northeastern Africa and southern

59 Green, "When Numbers Don't Count"; Keller et al., "Ancient *Yersinia pestis* Genomes," Fig. 1. For the evolution of the Justinianic strain outside of Central Asia, see Green, "Taking 'Pandemic' Seriously: Making the Black Death Global," *Medieval Globe*, I (2014), 27–61; Sarris, "New Approaches"; Spyrou et al., "The Source of the Black Death in Fourteenth-Century Central Eurasia," *Nature*, DCVI (2022), available at doi.org/10.1038/s41586-022-04800-3.

60 Sarris, "The Justinianic Plague," 171–172; *idem,* "New Approaches," 319; Procopius, *History of the Wars*, 2.22; Pseudo-Dionysius of Tel Mahrē, *Chronicle*, 80; Stathakopoulos, *Famine and Pestilence*; *idem*, *Crime and Punishment*; Rudolf Pfister, "Üble Kerne unter der Haut. Neu erschlossene medizinische Quellen zur Beulenpest im frühmittelalterlichen China," in Stefan Leenen et al. (eds.), *Pest! Eine Spurensuche* (Darmstadt, 2019); Procopius, *History of the Wars*, 2.5–6. For the Mesopotamian caravan route, see McCormick, "Toward a Molecular History," 303. We thank Marcel Keller for bringing our attention to the latter point.

Arabia via maritime merchant routes in the western Indian Ocean and the Red Sea. It is plausible that the plague either struck northeastern Africa directly from South Asia in the early sixth century or foci were established in Africa via trade with South Asia in the centuries preceding the outbreak at Pelusium. Rufus of Ephesus' account, which is most likely a description of bubonic plague affecting Egypt and Libya in the late first or early second century C.E., hints at the latter.

Sarris argues that documentary evidence from middle Egypt, specifically changes in land lease tenure in the sixth century, supports Africa as the probable origin of the pandemic. Using Banaji's statistical analysis of land leases recorded in papyri, he highlights a 22 percent increase in leases of indefinite duration and a 20 percent decrease in one-year leases in the second half of the sixth century, reflecting lessees' bargaining power following the initial (and seemingly worst) occurrence of the plague. Harper's dataset, also based on papyrological documents, presents contrasting economic data, showing dramatic drops in wheat prices, modest rises in real wages, and relatively consistent rent and land prices, suggesting that the impact on Egypt's economy was not significant.[61]

A 2019 study led by Mordechai claims that papyri do not reveal evidence of demographic contraction, land abandonment, tax revenue reductions, or shifts in land tenure in the decades after the Justinianic Plague first erupted. They argue that the data show no economic stress but suggest an increase in revenue of 30 percent for the wealthy Apion estate of Oxyrhynchus between the 540s and 580s, and an increase in the number of surviving dated papyri, from which they conclude that there were no plague-driven societal fractures in the latter half of the sixth century. Sarris rebukes their claim that "tens of thousands of papyri" dating to the period of the First Plague Pandemic (540–750 C.E.) have no mention of plague, saying that there are less than half of that number, and that in such documentary papyri (expenditure lists, tax receipts, and contracts) one would not expect to find references to disease. Sarris also notes that the Apion archive (a group of papyri from the best-documented Egyptian estate of late

61 Sarris, "The Justinianic Plague," 177–178; Jarus Banaji, "Rural Communities in the Late Empire CE 300–700: Monetary and Economic Aspects," unpub D.Phil. thesis (Univ. of Oxford, 1992), table 20. Harper, "People, Plagues, and Prices," 818–828, 834–835.

antiquity), which Mordechai and colleagues reference to argue for economic gains in Egypt after 540, has limited documentation from before the initial wave of the plague, and that the records show stability at most from the 540s onward, citing newer work on *P. Oxy* LXXXIV 5457 and 5466.[62]

Both sides present valid points, but there are nuances that need to be considered. Mordechai and colleagues are correct about the quantity of existing papyri broadly dated to the period under consideration; a simple papyri.info search produces 25,198 texts for the period 540–750 C.E., with just one metaphorical use of *loimos* ("plague" or "pestilence," in *P. Cair. Maps.* III 67283) and no mentions of *nosos* ("disease" or "sickness"). On the other hand, Sarris' more focused search, homing in on papyri securely dated in the text or paleographically to the period 550–750 C.E. and excluding broadly dated texts and those in languages other than Greek, yields 4,107 works.

Sarris is also right in stating that most papyri in the specified date range are not documents where references to disease would be expected. For example, explicit mentions of pestilence in papyri dating to the early-middle Imperial period (50–250 C.E.) come primarily from 1,982 private letters; there are only 268 such letters available for the period 540–750 C.E. Furthermore, the absence of references to plague in the papyri—or in any corpus—does not equate to the absence of a pandemic.

Regarding economic trends derived from papyri, evidence discussed by Sarris, Mordechai, and Harper, does not demonstrate significant economic change for the second half of the sixth century. Limited data from the Apion archive before 540 compromises Mordechai's argument for increased revenue and its implications for broader economic conditions in Egypt. However, these data do suggest short-term disruption of agricultural contributions from the estate's tenants in the early 540s, followed by recovery in the 560s at the latest, hinting that the plague's initial wave briefly affected the Oxyrhynchus area.[63]

62 Lee Mordechai et al., "The Justinianic Plague: An Inconsequential Pandemic?" *Proceedings of the National Academy of Sciences*, CXVI (2019), 25546–25554; Sarris, "New Approaches," 335–336.

63 Bransbourg, Bresson, and McDonald, "First Plague Pandemic in Africa."

Overall, papyrological evidence is not a smoking gun for the plague's origin or its impact in Egypt. The earliest indication of the pandemic is a report that it struck Pelusium in the summer of 541, followed soon after by an outbreak in Alexandria. If *Y. pestis* arrived at the delta via the Red Sea, as some have suggested, it could have spread south, causing serious damage in its path, which would explain papyrological evidence that points to disruption from mid-541 on. Without evidence of noteworthy financial changes firmly dating to before the summer of 541, which might suggest that the plague spread north from lands such as Aithiopia, the papyrological evidence remains ambiguous in determining the proximate origin of the pandemic.[64]

Keys advanced the theory that sixth-century climate change disrupted a central East African plague focus, in which wild rodents harboring the bacterium passed it to commensal rodents near the Swahili Coast, leading to the maritime coastal spread of *Y. pestis* from central East Africa to the Red Sea, through Trajan's canal and on to Pelusium. That genetic evidence indicates that Central Asia is the ultimate origin of the bacterium does not preclude central/southern East Africa (the region including modern Tanzania, Uganda, Kenya, Mozambique, and the ancient emporium Rhapta) from being the proximate origin of the Justinianic Plague. Archaeological evidence, however, suggests that this scenario is less likely. There is little evidence indicating that central East Africa was active in Indian Ocean trade in the sixth century C.E. and there is an absence of black rat (and other commensal rodent) remains in East Africa definitively dating to, or before, the early sixth century.[65]

64 For speculation on the role of the Red Sea, see McCormick, "Rats, Communications, and Plague: Toward an Ecological History," *Journal of Interdisciplinary History*, XXXIV (2003), 7–8; *idem*, "Toward a Molecular History," 303–304; Costas Tsiamis, Effie Poulakou-Rebelakou, and George Androutsos, "The Role of the Egyptian Sea and Land Routes in the Justinian Plague: The Case of Pelusium," in Demetrios Michealides (ed.), *Medicine and Healing in the Ancient Mediterranean World* (Oxford, 2014); Green, "The Black Death and Ebola: On the Value of Comparison," in *idem*, *Pandemic Disease in the Medieval World: Rethinking the Black Death* (Kalamazoo, 2015), xiv–xv; Newfield, "Mysterious and Mortiferous Clouds: The Climate Cooling and Disease Burden of Late Antiquity," *Late Antique Archaeology*, XII (2018), 97–103; Green, "Putting Africa on the Black Death Map."

65 David Keys, *Catastrophe: An Investigation into the Origins of the Modern World* (London, 1999), 15–26. Eivind H. Seland, "Archaeology of Trade in the Western Indian Ocean, 300 BC–AD 700," *Journal of Archaeological Research*, XXII (2014), 379–380; Boivin et al., "East Africa and Madagascar," 244–249; Prendergast et al., "Reconstructing Asian Faunal

The black rat (*Rattus rattus*) was very likely involved in some Justinianic Plague outbreaks. Although the bacterium can infect other mammalian populations, the black rat's tendency to cross paths with sylvatic/wild rodents—the natural reservoir of *Y. pestis*—and follow humans, makes it the likeliest culprit in triggering sixth-century plague epidemics. Black rat remains are found throughout the Mediterranean region at Roman-period sites, and they have been historically linked to bubonic plague epidemics in Eurasia and Africa. *R. rattus* originated in South Asia and probably reached Africa through Indian Ocean trade. The earliest firm archaeological evidence of the black rat in Africa dates to Hellenistic and Roman times, but the archaeology also suggests that it may not have arrived to the central/south East African coast until the seventh or eighth century C.E., casting doubt on *Y. pestis* spreading to Egypt from that region.[66]

Introductions to Eastern Africa from Multi-proxy Biomolecular and Archaeological Datasets," *PloS ONE*, XII (2017), 13–14. One black rat skeleton from an assemblage found at the Swahili Coast, on the island of Unguja, returned a calibrated radiocarbon date range of 421–535 C.E. at 2σ, but this skeleton had a low gelatin yield and was by far the earliest date—the others dating to the seventh century or later—prompting researchers to surmise that the date range was influenced by a reservoir effect, given the likelihood that black rats on the island had a marine diet. On land use and urbanization in Sub-Saharan Africa, see Andrea Kay and Jed Kaplan, "Human Subsistence and Land use in Sub-Saharan Africa, 1000 BCE to CE 1500: A Review, Quantification, and Classification," *Anthropocene*, IX (2015), 14–32. Green notes that the urban networks necessary for the survival of commensal rodents, and thus the spread of *Y. pestis* overland, were lacking in Sub-Saharan Africa prior to the medieval period—a picture that, historically and archaeologically, has yet to change; however, in a later paper Green discusses the possibility that plague may move long distances without mammalian populations to support it, the bacterium staying alive in fleas and flea feces without causing epidemic outbreaks. Green, "Taking Pandemic Seriously," 43; *idem*, "The Four Black Deaths," *American Historical Review*, CXXV (2020), 1601–1631. See also Newfield, "Mysterious and Mortiferous Clouds," 97–99.

66 For black rats in archaeological contexts, see McCormick, "Rats, Communications, and Plague"; *idem* et al., *Archaeology of Rats 1–1500 Database*, Harvard Dataverse (Cambridge, Mass., 2013). On the role of commensal rodents in plague ecology, see Pollitzer, "Hosts of the Infection"; Dennis et al., *Plague Manual*, 63–87; Bastiaan G. Meerburg et al., "Rodent-Borne Diseases and Their Risks for Public Health," *Critical Reviews in Microbiology*, XXXV (2009), 221–270; Vladimir M. Dubyanski and Aidyn B. Yeszhanov, "Ecology of *Yersinia pestis* and the Epidemiology of Plague," in Ruifu Yang and Andrey Anisimov (eds.), *Yersinia pestis: Retrospective and Perspective* (Dordrecht, 2016). The earliest evidence of *M. musculus*, or the house mouse, in Africa dates to the late first millennium C.E. Boivin et al., "East Africa and Madagascar," 249. On the origin and early spread of *R. rattus*, see Mumtaz Baig et al., "Phylogeography of the Black Rat *Rattus rattus* in India and the Implications for Its Dispersal History in Eurasia," *Biological Invasions*, XXI (2018), 417–433; Emily Puckett, David Orton, and Jason Munshi-South, "Commensal Rats and Humans: Integrating Rodent Phylogeography and Zooarchaeology to Highlight Connections Between Human Societies," *Bioessays*, XLII

Roman commerce, particularly the grain trade, and urbanization played a crucial role in the spread of black rat populations, and thus probably the emergence and spread of *Y. pestis* foci. The decline of the black rat in Europe between the sixth and eighth centuries C.E. could be, along with the decline of the Western Roman Empire and sixth-century climate change, a direct result of the First Plague Pandemic. This suggests an essential link between black rats and the pandemic, their presence conceivably facilitating transmission of *Y. pestis* over long distances and the acute urban outbreaks reported by Byzantine authors.[67]

Although the lack of commensal rodent finds in central East Africa does not invalidate Keys' theory for how *Y. pestis* reached Egypt, limited evidence for the region's involvement in Indian Ocean trade before the seventh century C.E. makes it less likely as the plague's proximate origin. The bacterium more likely spread to the Mediterranean either directly from south Asia, or via the Nile River from a focus between Egypt's southern border and the Horn of Africa, or from ports where black rats existed before the pandemic and at which archaeological evidence shows active

(2020); on the black rat in Africa, see Louis C. E. Loriet and Claude Gaillard, "La faune momifiée de l'ancienne Égypte," *Publications du musée des Confluences*, VIII (1903), 38–40. Remains at Myos Hormos reported in Angela von den Driesch and Joachim Boessneck, "A Roman Cat Skeleton from Quseir on the Red Sea Coast," *Journal of Archaeological Science* X (1983), 205–211; Phillip Armitage, Barbara West, and Ken Steedman, "New Evidence of Black Rat in Roman London," *London Archaeologist*, IX (1984), 380. Remains of *R. rattus* and *Mus musculus* were found at Tell el-Dab'a in the Nile Delta in an eighteenth-century B.C.E. context, but dating integrity has been questioned due to probable burrowing and the original reporter of the finds. Joachim Boessneck, "Tell el-Dab'a III: Die Tierknochenfunde 1966–1969," *Untersuchungen der Zweigstelle Kairo des Österreichischen Archäologischen Institutes* III [1976]. Boessneck did not include them in a review of Ancient Egyptian fauna 12 years later. Boessneck, *Die Tierwelt des alten Ägypten: Untersuchungen anhand kulturgeschichtlicher und zoologischer Quellen* (Munich, 1988); Boivin et al., "East Africa and Madagascar," 214, 244–248. For remains at Berenike, see Wim Van Neer and Anton Ervynck, "Faunal Remains," in Sidebotham and Willemina Wendrich (eds.), *Report of the 1996 Excavations at Berenike and the Survey of Egyptian Eastern Desert* (Leiden, 1998), 367; Henrietta Baron, "An Approach to Byzantine Environmental History: Human-Animal Interactions," in *idem* and Falko Daim (eds.), *A Most Pleasant Scene and an Inexhaustible Resource: Steps Towards a Byzantine Environmental History* (Mainz, 2017), 187–189, 193; Sidebotham pers. comm.

67 Puckett, Orton, and Munshi-South, "Commensal Rats and Humans," 7; He Yu et al., "Palaeogenomic Analysis of Black Rat (*Rattus rattus*) Reveals Multiple European Introductions Associated with Human Economic History," *Nature Communications*, XIII (2022), 1–13; Harper, "The First Plague Pandemic in Italy," 415–417.

Indian Ocean trade in the sixth century—such as ports in or near the Red Sea.[68]

Procopius claims the plague started at Pelusium, but other ancient authors suggest Kush or Aithiopia. Zacharias Rhetor, also contemporary with the initial wave, claims that the plague originated from Kush, "that is on the border of Egypt," and seventh/eighth-century bishop Jacob of Edessa says the same. Evagrius Scholasticus claims that "it was said, and still is now, to have begun in Aithiopia." Evagrius notes that this disease is of different symptomatology than Thucydides' description of the Plague of Athens and recognizes the coincidence regarding its origin, a point noted by Sarris, thus his claim that it began in Aithiopia should not be discounted as a *topos*. Evagrius wrote the passage soon after the plague's third recurrence (594), which affirms that it was thought to have originated in Aithiopia. Adding "it was said, and still is now," suggests that this was a view widely held for five decades. John of Ephesus points both to Kush and to the Himyarite Kingdom (modern-day Yemen), that is, the regions on either side of the southern Red Sea, as the places experiencing the earliest outbreaks. An inscription at Marib (located in what was Himyarite territory) mentions a pestilence that affected the whole community in the 540s, appearing to corroborate John's claim that plague struck the region. If John's account is true, it implies that the bacterium crossed the Red Sea, which suggests maritime movements in *Y. pestis*' spread northward toward the Mediterranean. Such movement would explain the sudden large-scale outbreak at the urban deltaic port not far from the head of the Red Sea. That maritime connectivity is attested between these two regions in the early sixth century strengthens this scenario's plausibility.[69]

Archaeological evidence demonstrates exchange between the African and Arabian sides of the Red Sea from the fourth to seventh centuries C.E., particularly at Adulis (an important port on the African side belonging to the Kingdom of Aksum, which rose to control the region and became geographically synonymous with

68 On problems past and present in finding rat bones in archaeological contexts, see McCormick, "Rats, Communications, and Plague," 5–6.

69 Geoffry Greatex (trans. Robert R. Phenix and Cornelia B. Horn), *Chronicle of Pseudo-Zachariah Rhetor* (Liverpool, 2011), 414; *Chronicon Jacobi Edessini*, 5.320, 6.424; Evagrius Scholasticus (trans. Michael Whitby), *Ecclessiastical History*, 4.29; Sarris, "Origins and Effects"; *Chronique de Michel le Syrien*, 9.26.305. For the Arabian inscription, see Robin, "Guerre et épidémie."

Kush and Aithiopia in the minds of late antique authors). Similar evidence was recovered from a merchant shipwreck off the coast of Black Assarca Island (part of modern Eritrea), and from Qani, a Himyarite port on the coast of southern Arabia.[70]

Written evidence implies "continuous contact," either violent or peaceful, between the Axumite and Himyarite kingdoms preceding and coinciding with the Justinianic pandemic. The Axumite Kingdom controlled maritime trade in the southern Red Sea and the western Arabian Sea from the start of the sixth century until peace was made with the Himyarites in 525. Around the same time, there is evidence of contact between peoples of the southern coasts of the Red Sea and the northern, Roman/Byzantine realm, particularly at Clysma, a Roman port that *Y. pestis* might have reached before passing through Trajan's Canal and on to Pelusium. Sixth-century contact between the peoples of "Kush" and Arabia supports John of Ephesus' claim, though it is not evidence of plague in the Red Sea. But the abandonment of the Red Sea port Berenike by the mid-sixth century suggests that the bacterium not only passed through the Red Sea but also afflicted societies therein.[71]

70 For Adulis, see David Peacock and Blue, *The Ancient Red Sea Port of Adulis, Eritrea Report of the Eritro-British Expedition, 2004–5* (Oxford, 2007); Chiara Zazzaro and Andrea Manzo, "A Preliminary Assessment on the Pottery Assemblage from the Port Town of Adulis (Eritrea), *British Museum Studies in Ancient Egypt and Sudan*, XVIII (2012), 238; Zazzaro, *The Ancient Red Sea Port of Adulis and the Eritrean Coastal Region: Previous Investigations and Museum Collections* (Oxford, 2013). See n. 9 for the use of *Aksum*, *Kush*, and *Aithiopia* in ancient literature. For similar evidence elsewhere in the Aksumite kingdom, see Munroy-Hay and Phillipson, *Excavations at Aksum: An Account of Research at the Ancient Ethiopian Capital Directed in 1972–4 by the Late Neville Chittick* (London, 1989); Phillipson, *Ancient Ethiopia*; Zazzaro, *The Ancient Red Sea Port of Adulis*. For Black Assarca Island, see Ralph K. Pedersen, "The Byzantine-Aksumite Period Shipwreck at Black Assarca Island, Eritrea," *Azania*, XLIII (2008). For Qani, see Alexandre V. Sedov and Jean-Françios Salles, *Qāni': le port antique du Ḥaḍramawt entre la Méditerranée, l'Afrique et l'Inde: fouilles russes 1972, 1985–89, 1991, 1993–94* (Tournhout, 2010), 466. For trade between the Himyarite Kingdom and the Byzantine Empire, see Munroy-Hay, "Coins of Ancient South Arabia, II," *Numismatic Chronicle*, CLVI (1996), 33–47.

71 Procopius, *History of the Wars*, 1.19; Munroy-Hay, *Aksum*, 55, 88; Seland, "Archaeology of Trade in the Western Indian Ocean," 381. Tsiamis, et al. "The Role of the Egyptian Sea"; Harper, *Fate of Rome*, 217. For Berenike, see Sidebotham and Willeke Wendrich, *Berenike 1999/2000: Report on the Excavations at Berenike, Including Excavations in Wadi Kalalat and Siket, and the Survey of the Mons Smaragdus Region* (Los Angeles, 2007); Sidebotham, *Berenike*; *idem* et al., "Berenike 2019: Report on the Excavations," *Thetis*, XXV (2020), 175–193; *idem* et al., "Results of the Winter 2020 Excavation Season at Berenike (Red Sea Coast), Egypt," *Thetis*, XXVI (2021), 247–281.

The timing of the arrival of *Y. pestis* to this region from central Asia is the crucial, but currently unanswerable, question. Several scenarios are possible. Was a focus of the bacterium established centuries before the First Plague Pandemic in northeast Africa, and did it spread through the Red Sea or down the Nile in the early sixth century? Did it focalize in southern Arabia and then spread to Kush/Aithiopia/Aksumite territory in the late 530s or early 540s? Did the bacterium come directly across the Indian Ocean from South Asia in the early sixth century? The "relative prosperity" of Indian Ocean trade attested through at least the early seventh century C.E. provides a potential pathway for the bacterium's transfer from Asia to Africa, which coheres with John of Ephesus' reference to plague in Kush and southern Arabia. South Asian merchants likely stopped at southern Arabian ports such as Qani (which archaeology attests was active until the early seventh century C.E.), as well as the island of Socotra, which was a significant trade hub, indicated by cave inscriptions in various languages up to the sixth century C.E.[72]

The exact path of the Justinianic Plague can only be better traced with new evidence, especially new aDNA evidence, which can improve both our understanding of where and when the strain struck and its genetic history. Although other routes of spread are not ruled out, current evidence suggests that the western Indian Ocean and northeast Africa played an early and critical role in the First Plague Pandemic, with Egypt possibly acting as the bacterium's gateway to the Mediterranean.

Ancient Egypt was considered disease-ridden by several of its neighboring cultures, including the Hittites, the Israelites, and the Greeks, who believed that epidemics were imported from Egypt. The disease that infected the Hittite king, Šuppiluliuma I, and his son remains unidentified, as is the pathogen responsible for the epidemic at the workmen's village of Amarna. It could be that the Ebers medical papyrus from the second millennium B.C.E.

72 Sarris, "Origins and Effects," 171; Seland, "Archaeology of Trade in the Western Indian Ocean," 384. Green, "Taking 'Pandemic' Seriously," 47. Salles and Sedov, *Qānī'*. For the Soctran inscriptions, see Ingo Strauch, *Foreign Sailors on Socotra: the Inscriptions and Drawings from the Cave Hoq* (Bremen, 2012); Harper, *Fate of Rome*; Sidebotham, *Berenike and the Ancient Maritime Spice Route*.

is describing bubonic plague, and the references to incurable and lethal "boils of Egypt" in Exodus and Deuteronomy might be doing the same. Rufus of Ephesus was almost certainly describing outbreaks of bubonic plague in early Roman Libya, Egypt, and Syria, as was Aretaeus in Cappadocia in the second century C.E. None of these regional epidemics developed into pandemics, as far as we know.

Thucydides' narrative about the Plague of Athens and its origin in "Aithiopia" was particularly influential, with later authors describing contemporary pestilences by drawing on his account. The Antonine and Cyprianic plagues were similarly linked to Egypt or Aithiopia, but the evidence does not strongly tie their origins to northeast Africa, and nor has archaeogenetic research yet helped to answer where they emerged, let alone identify their pathogenic culprits. Conversely, the collective evidence for the Justinianic Plague does indeed point to the pandemic having first passed through Egypt on its way to the Mediterranean.

The papyri improve our understanding of ancient disease events in Egypt, but they do not significantly alter ongoing debates about societal or economic impacts of the pandemics or their origins. The papyri do, however, shed light on how epidemic events were documented in antiquity, that there were no references to disease (using *loimos* specifically) in the Hellenistic period, and that there is an apparent increase in mentions of pestilence starting in the early second century C.E.

We have on the one hand a powerful literary *topos* begun by Thucydides' description of the Plague of Athens, and on the other, sufficient evidence from the beginning of history down to late antiquity that, in some cases, Egypt may in fact have acted as a gateway for pathogens spreading from south Asia, southern Arabia, or East Africa, by way of the Nile and/or Red Sea routes, northward to neighboring regions like Libya, the Levant, and the wider Mediterranean. It is thus important to consider the details of ancient disease events to discern whether authors relied on Thucydides' description for origin and symptomatology or if references to Aithiopia as an epidemic's birthplace align with other evidence.

That true plague reached northeast Africa long before the outbreak at Pelusium in 541 C.E. seems probable. Even though the Justinianic strain of *Y. pestis* probably emerged in the first few centuries of the Common Era, accounts from ancient physicians lend to the idea that earlier strains may have passed through the Red Sea/northeast Africa. The descriptions suggest that the peoples of Egypt and Libya experienced symptoms that are highly suggestive of bubonic plague in late Hellenistic or early Roman times—an early period of contact between Egypt, Southern Arabia, and South Asia. Thus plague could have reached Egypt in the sixth century *either* directly from South Asia through Indian Ocean trade *or* from an African focus established in the early Roman period. Sixth-century authors may indeed have been recording accurate details on the origin of the Justinian Plague and not merely copying Thucydides.

Recent research in archaeogenetics has narrowed historical gaps and provides pathways to investigate the interplay between human agency and environment. Genetic research on remains of presumed victims of the First Plague Pandemic illustrate the potential of molecular investigations in altering historiography. Similar analyses on human remains, particularly from Egypt, that are tentatively linked to other ancient pestilences, such as the Athenian, Hadrianic, Antonine, Septimian, and Cyprianic disease events, could provide information about ancient disease agents and the societies they influenced, as well as contribute to our collective understanding of pathogen evolution and epidemiology over time and space.