



## THE CRISIS OF THE SIXTH CENTURY: CLIMATIC CHANGE, NATURAL DISASTERS AND THE PLAGUE

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### ABSTRACT

The Byzantine period (fourth-sixth centuries) is considered an era of peak prosperity in agriculture and trade in the eastern and southern Mediterranean. Paleoclimatic studies have pointed to a significant increase in rainfall from the early fourth century onward, the beginning of a more humid period that lasted some two hundred years. However, the economic prosperity of the Byzantine Empire and its achievements in the fields of urban development and trade were halted in the mid-sixth century. In the second half of the sixth century and through the seventh century we can discern a sharp decline in both urban and rural settlement. The plague known as the "Justinianic plague" broke out in the summer of 541 and spread rapidly via trade ships throughout the Empire. At the same time the period of humid climate that had begun in the fourth century came to an end. For the Byzantine farmer the combination of plague and drought was disastrous. This paper focuses on the circumstances and implications of the severe crisis that affected the Levant during the sixth century.

**KEY WORDS:** Paleoclimate, Natural disaster, Plague, Trado, En-Gedi, Petra, Mampsis, Muslims

### ARCHAEOLOGICAL INDICATIONS OF THE CRISIS

Are there archaeological remains that point to a crisis in the mid-sixth century? In

the excavations that I directed in the village of En-Gedi on the western shore of the Dead Sea, it became clear that around 600 AD, the entire village was destroyed in a fierce fire



Fig. 1: The village of En-Gedi, looking west. It was burnt and abandoned towards the end of the sixth century.

(Hirschfeld 2004a, 67). Layers of soot and ash covered the floors in most of the houses, shops and storerooms, and even the streets (fig. 1). The village may have been destroyed by nomads; from the literary sources (e.g. Moschus 1992, 155) we know of the violent incursions carried out by Saracens, i.e. pre-Islamic Arab tribesmen. The excavations at En-Gedi have shown that the village was totally abandoned and was not reoccupied until the Mamluk period. The abandonment of a village was a catastrophe for its inhabitants, who at best became destitute refugees.

En-Gedi was not the only site that suffered a disaster in the second half of the sixth century. At Mampsis (fig. 2), in the northeastern part of the Negev Desert, the north gate was destroyed by fire in the mid-sixth century and the entire site was abandoned (Negev 1988, 7-8). Petra was badly damaged in an earthquake in 551 and

the church in which charred papyri were discovered (fig. 3) was destroyed in a fierce fire in about 580 (Fiema 2003, 247-249). A sharp urban deterioration is discernible in cities of the Decapolis like Gerasa (MacAdam 1994, 76). The excavators of Scythopolis (Bet Shean) point to the mid-sixth century as the beginning of degeneration and decline in the life of the city (Tsafirir and Foerster 1997, 125-126, 141-143).

A similar picture of abandonment is reflected by excavations and surveys of farmhouses. A survey of farmhouses in the area of Dor established that there was massive abandonment of structures toward the end of the sixth century (Gibson, Kingsley and Clark 1999, 108). Similarly, the Byzantine farmhouse that I excavated at Horvat 'Aqev in the southern Carmel hills (fig. 4) was abandoned well before the end of the Byzantine period (Hirschfeld 2000, 727).



Fig. 2: Aerial view of Mampsis, looking south. The tower was burnt in the mid-sixth century.

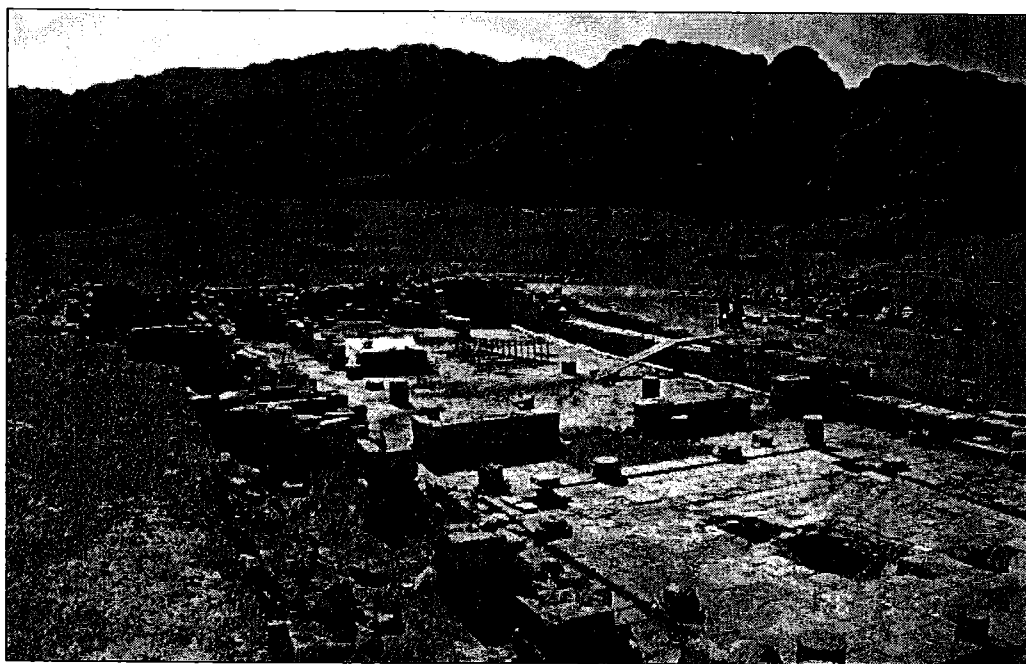


Fig. 3: Petra, the church of the charred papyri, looking southeast. The church was burnt around 580 AD.



Fig. 4: The farmhouse at Horvat 'Aqev, looking southwest. It was abandoned before the Muslim conquest.

Such abandonment is also discernible in the villages of northern Syria. The research of Jean-Pierre Sodini and George Tate, based on the excavation of the village of Dehes and many others, has demonstrated that the peak of rural settlement in northern Syria was in the period of 350-550. They note widespread abandonment of villages around the year 600 (Sodini *et al.* 1980; Tate 1992). In Asia Minor the picture is similar: previously flourishing settlements like Sagalassos and Anemurium were abandoned in the mid-sixth century (Morrisson and Sodini 2002, 191-192). On the basis of these data, scholars have pinpointed the mid-sixth century as the beginning of the end of the Byzantine period (Kennedy 1985a, b).

It is true that in some areas we may point to continuity of the settlement picture. In Transjordan, for instance, there was a marked flourishing of settlement, including the massive building of new churches and the

production of splendid works of art. Surveys and excavations carried out in Jordan, the Negev and the Arava attest to the continued existence of farms after the Muslim conquest (Haiman 1995; Magness 2003). It appears that not all regions were equally affected by the crisis of the mid-sixth century and that the human response to the crisis varied from place to place.

In my view, the destruction and abandonment of En-Gedi, Mamfisis, Petra and other sites in the sixth and early seventh centuries are early signs of the disintegration of the Late Roman Empire in the East. They should be seen as the first cracks that would eventually lead to the fall of the eastern parts of the Empire, first to the Persians in 610 and then to the Muslims in 636. What were the reasons for these shocks? I will point to three possible reasons for the destabilization of the Empire: climatic change, natural disasters and the plague.

## 1. CLIMATIC CHANGE

In a recently published article (Hirschfeld 2004ab) I presented archaeological evidence for a climatic improvement in the Levant at the beginning of the Byzantine period. The relatively cool and humid climate of the Byzantine period lasted for some 200 years, from ca. 300 to ca. 500. Around the year 500 the climate changed once again, this time for the worse. The change was gradual and took place over about a century (Issar 1995). Archaeological support for this may be found at sites in which springs dried up and were covered by sand dunes. For example, at 'En Hatzeva the spring, which supplied abundant water to the nearby bathhouse in the Late Roman and Byzantine periods, dried up at the end of the Byzantine period (Cohen and Israel 1996, 90-91). The monastic farm near 'En 'Aneva in the Judean Desert (fig. 5), founded in the Byzantine period, was abandoned at the end of the period, again because of the drying up of the spring (Porath 2001). Near Yavneh-

Yam in the Mediterranean coastal plain, a Byzantine well was abandoned in the mid-sixth century because of its drying up and blocking by sand (Ayalon 1999). All of this accords well with the testimony of Procopius of Gaza, who sent to his friend Jerome of Elusa a letter describing how the roots of the vines had been exposed by a combination of drought and relentless winds (Mayerson 1983, 252). It should be noted, however, that at the time of the Muslim conquest the economy of the region was still viable, and that it is only in the eighth century that we witness the collapse of agricultural settlement.

Analysis of ancient Dead Sea levels supports the assumption that a warm, dry period began toward the end of the Byzantine period (Enzel *et al.* 2003). In the mid-sixth century the level fell to -400 meters and it continued to fall in the seventh and eighth centuries, eventually reaching a level of -412 meters, the lowest recorded level before modern times (fig. 6).

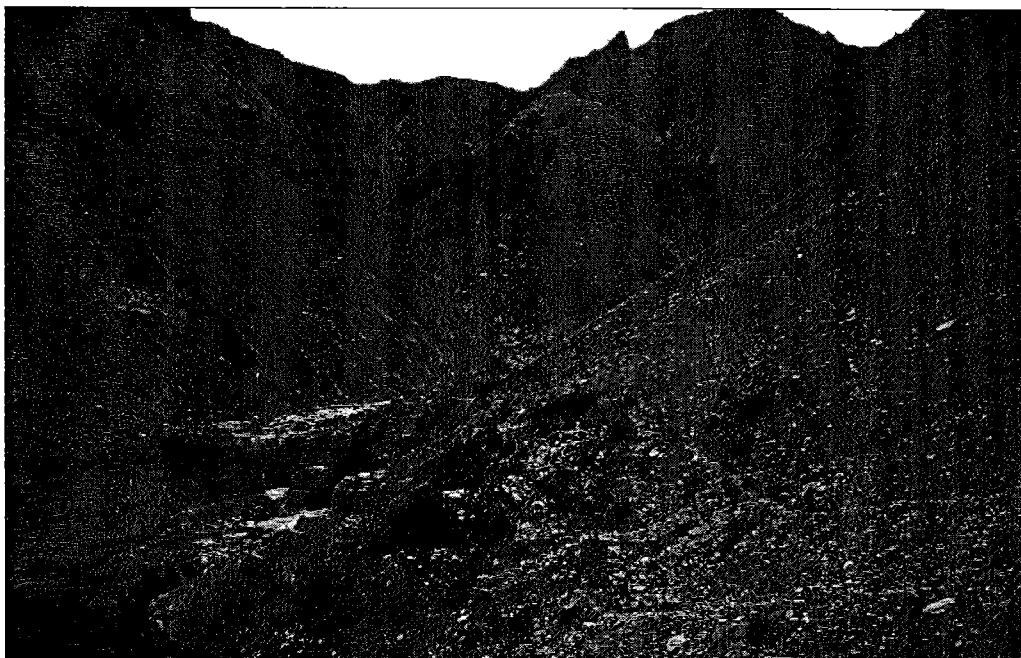


Fig. 5: The monastic farm at 'En 'Aneva, looking northwest.

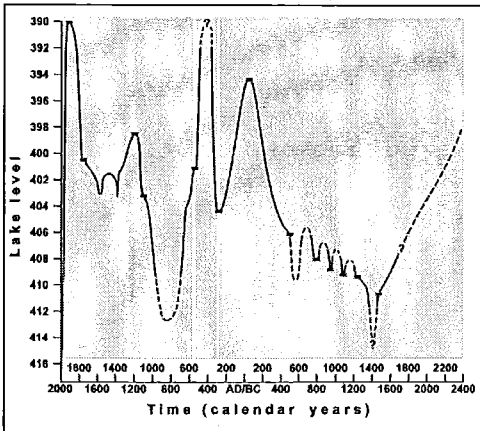


Fig. 6: Graph showing the fluctuations of the Dead Sea level. Note the drop in the level during the late Byzantine and early Muslim periods (based on the work of Enzel *et al.* 2003).

The climatic change that occurred in the Levant in the sixth and seventh centuries brought disaster. The economic system that was based on agriculture began to collapse. In areas dependent on dry farming, the reduction of rainfall and increase of drought years led to impoverishment of the soil, famine and abandonment. The inhabitants of the large villages abandoned their lands or reverted to an economy that was increasingly based on herding. The process that began in the mid-sixth century and continued through the first half of the seventh century affected first and foremost the large settlements. For example, excavations have shown that two large settlements in the southern Judean hills, Tel Ma'on and 'Anim, were abandoned before the Muslim conquest (Amit 2003, 19, 132 respectively), as were two large settlements of the Negev, Rehovot (Tsafirir 1977, 7-8) and Avdat (Negev 1997, 151-152). On the other hand, Haiman (1995) has demonstrated that the farmhouses of the Negev survived until the end of the Umayyad period. I believe that we should adopt the model proposed by Gideon Avni (1996, 86-87), according to which the large Byzantine settlements of the Negev were

gradually abandoned; some of their inhabitants left the region and others took up residence in remote farmhouses, reverting to a pastoral economy based on herding. It appears that the abandonment was gradual and that the existing systems were maintained as long as the climatic conditions permitted. Only prolonged years of drought, as well as political factors, brought the changes leading to the final abandonment of the settlements.

## 2. NATURAL DISASTERS

Another factor that led to economic and demographic decline during the sixth century was natural disasters. The most common natural disasters are earthquakes. During the sixth century, five earthquakes (in 525, 533, 548, 554 and 557) are recorded in Constantinople (McCormick 2003, 18) and two (in 526 and 528) in Antioch (Foss 1997, 190). In 551 a strong earthquake occurred in the Levant and caused extensive damage in the Galilee and in cities such as Jerusalem, Gerasa and Petra (Amiran *et al.* 1994, 266). In the excavations of Bet Shean the excavators identified damage caused by a major earthquake in the late sixth or early seventh century (Tsafirir and Foerster 1997, 143); the excavation that I conducted at the site of 'Ein et-Tue'ina on the western slopes of the Golan Heights revealed additional traces of this earthquake. However, earthquakes are generally not an adequate reason to explain the abandonment of settlements and the collapse of economic systems. From this point of view the earthquake of 749, which resulted in the total destruction of settlements and the abandonment of towns such as Hippos (Susita), is an anomaly (fig. 7), since in most cases the local people repair the earthquake damage and resume their lives. An example of this is the great earthquake of 363, which damaged settlements throughout the region but did not interrupt their prosperity.

However, in the mid-sixth century the



Fig. 7. Hippos (Susita), destroyed in the earthquake of 749 and subsequently abandoned: the cathedral, looking west.

sources tell us of natural disasters on an unusually large scale. Michael McCormick of Harvard University, who studied the outbreak of plague that will be discussed later, lists the following occurrences. In 530 Constantinople suffered from a drought that restricted water supplies. In 536 Persia was affected by a drought that was no less severe. In 540 heavy snow fell in Syria, and in the same year the River Po in Italy broke its banks and flooded the region (McCormick 2003, 20). However, the most serious natural disaster apparently took place in 536. According to Procopius of Caesarea, the quintessential historian of the sixth century, in Justinian's tenth regnal year the light of the sun dimmed and for an entire year the sun shone like the moon (Procopius, *Wars* IV, 14, 4-6). John of Ephesus, a contemporary of Procopius, relates that the sun was dimmed for a year and a half (the text is

preserved in the *Chronicle of Michael the Syrian*, IX, 296). Evidence of the cosmic dust that veiled the sun has been supplied by dendrochronology (Baillie 1995). David Keys (2000) has recently published a new theory, claiming that the event of 536 was a natural disaster on a huge scale that took place as the result of a volcanic eruption in the region of the Equator. The eruption, which Keys believes was in southeast Asia, created a volcanic cloud that veiled the sun for a year or more. The darkening of the sun as a result of atmospheric pollution set off a chain reaction of climatic chaos, alternating between severe floods and severe droughts. In East Africa, according to Keys, the event of 536 caused a fatal combination of floods and droughts that upset the natural balance between predators and prey in the wild. In Central Africa the natural pool of rodents multiplied out of all proportion,

creating the conditions that led to the outbreak of the plague. In his book, Keys points to the event of 536 as marking the end of the urban era in antiquity and the beginning of the early Middle Ages. The event triggered a series of disasters that reduced the population and caused economic damage throughout the Empire. The first and most serious of these disasters was the great outbreak of plague in 541/1.

### 3. "THE GREAT PESTILENCE"

Two of the great achievements of the Byzantine period, the increase of population in the cities and towns and the development of international trade, created the conditions for the rapid and catastrophic spread of the plague. The epidemic of bubonic plague, known as "the Justinianic plague" or simply "the great pestilence", is considered the central event that shaped the sixth century (Stathakopoulos 2004, 110-147). It is believed to be the first pandemic of the plague in human history. Contemporary writers, such as Procopius, John of Ephesus and Evagrius Scholasticus, have left detailed accounts of the plague and its results (Dols 1977, 14-21; Allen 1979). The plague broke out in Egypt in 541, reaching Constantinople in spring 542 via Gaza, Antioch, Syria and the Balkans (fig. 8). It struck mainly the coastal cities and the settlements along trade routes, reaching the West in 543. It continued to break out in cycles of ten to fifteen years for some two centuries, until the mid-eighth century. Accordingly, this was not an isolated outbreak but a prolonged pandemic with long-term consequences. After the eighth century the disease declined; it broke out once again on a similar scale only in the fourteenth century.

The plague traveled via rats and their fleas from place to place and from person to person without any perceptible pause. Everywhere it caused a drastic reduction of population, and as a result the abandonment of agricultural land.

John of Ephesus, who visited Palestine and Syria at this time, describes unharvested wheatfields and herds of beasts without a herder. Trade entirely ceased and building projects were suspended, presumably for lack of labor. Leah Di Segni of the Hebrew University of Jerusalem collected 182 building inscriptions dated between 350 and 800. For the first ten years of the plague, 540 to 550, there is not a single building inscription, hinting at a cessation of public works due to the plague (Di Segni 1999, 163). Patlagean (1977, 427) points to a decline in the building of monasteries after 550. Subsequent waves of the plague broke out in different places. In 612 the outbreak was in Alexandria, and in 638/9 it was in Emmaus west of Jerusalem. The latter outbreak claimed many victims in the Muslim army (25,000 according to the sources) and the town was subsequently abandoned (Dols 1977, 21-22). The sources describing the plague contain repeated calls for repentance and view the disease as an expression of the divine will (Conrad 1981; 1986).

In order to understand the results of the epidemic and its effects on different components of society in the Byzantine period, it is important to understand the plague. Giora Frenkel of Tel Aviv University, a physician, has studied the characteristics of the disease (Frenkel 2003). He contends that the plague, unlike other communicable diseases, has retained its characteristics into modern times and that consequently it can be studied on the basis of modern medical research.

The plague is considered the most deadly of communicable diseases. The organism that causes the disease, named *Yersinia pestis* after its discoverer, Alexander Yersin, is susceptible to sunlight, heat and dry conditions. The organism reproduces within populations of rodents living in underground caves. In nature there is a constant pool of bacteria and the disease is endemic among rodent populations, maintaining a balance between sick and





Fig. 8: Map showing the progress of the Justinianic plague.

healthy individuals. There are two rodent pools in which *Yersinia* is endemic, one in the foothills of the Himalayas between India and China and the other in Central Africa (Keys 2002, 21-25; McCormick 2003, 1-2).

The plague is spread by fleas. When a flea sucks the blood of an infected rodent, it draws in blood containing bacteria and these create an intestinal blockage. The hungry flea then moves to a healthy rodent, but the infected blood cannot pass the blockage and enters the bloodstream of the rodent, thus infecting it. The fleas, desperate to receive nourishment, spread the disease. When the entire population of rats in the wild is dead the fleas move to urban rats, and when these are dead the fleas move to the human population.

The rodents that are the main vector for the spread of the plague among humans are two species of rats: the black house rat (*Rattus rattus*), which is common in densely populated settlements, and the brown rat (*Rattus norvegicus*), also known as the wharf rat (Frankel 2003, 6-10; McCormick 2003, 5-14). The house rat is timid and does not travel great distances. It is omnivorous, can survive in water and can jump over obstacles of a meter or more. It is highly susceptible to the plague, and an outbreak will cause high mortality among rats and the migration of their fleas to humans. The brown rat, on the other hand, is active and aggressive. It tends to migrate, particularly in merchant ships. Unfortunately, the brown rat is resistant to the plague, and consequently can transfer infected fleas on its body over long distances. The combination of the two species of rats is what makes the plague so deadly. When the epidemic begins the urban black rats die in large numbers and transfer the disease to humans, while the more resistant brown rats carry the disease from port to port and at each new place infect the local rat population.

There is thus a symbiotic relationship between rat and human populations.

McCormick (2003, 13) points to the development of the Roman city as the optimal breeding ground for rats, and to local and international trade routes as corridors for the spread of rats throughout the Empire. In the Roman-Byzantine period the great trading centers constantly grew in size. The relatively humid climate of the early Byzantine period contributed to population pressure in the provincial towns as well. Large quantities of refuse accumulated on the margins of towns and large villages and encouraged the spread of rats. Thus, for example, at Elusa in the Negev the urban refuse tip was identified in the northwestern part of the city (Negev 1993, 380). In Naples, entire insulae became refuse tips in the mid-fifth century (McCormick 2003, 17). In many cities, such as Bet Shean, the urban order that characterized the Roman period broke down (Tsafir and Foerster 1997, 100-101). Streets took on the character of alleys, public squares were filled with private construction, sewage flowed in the streets, and piles of dust and dirt were left everywhere — in short, ideal conditions for the establishment of large colonies of rats all over the city.

The large trading centers and densely populated provincial towns of the sixth century became death traps for their inhabitants in times of plague. However, the smaller villages and isolated farmhouses were less vulnerable. This may perhaps explain the survival of many farmhouses in the Negev into the Umayyad period.

The spread of the plague along trade routes is connected with the tendency of the brown rat to migrate from place to place, usually in sacks of wheat. The ships that transported the wheat from Alexandria via the coastal cities of Palestine and Syria to Asia Minor and from there to Constantinople were the main channel for the spread of the plague. From the ports the wheat was transported in wagons to the inland settlements. This enabled the rats to travel from place to place and to colonize towns and

large villages. On the other hand, transport of goods to more distant mountainous and desert regions was carried out by pack animals. Several mosaics found in Palestine and Jordan depict the transport of wine jars and other goods by donkeys and camels. This means of transport was less conducive to the spread of the plague. It is no coincidence that the rural population of these areas, according to the archaeological evidence, was much less severely affected by the plague. The unpaved roads were unsuitable for the passage of wagons and thus the dispersion of rats to remote rural areas was prevented. This may explain the continued prosperity of Transjordanian settlements like Madaba, Umm al-Rasas and Khirbet Samra, among others. Their distance of some two hundred kilometers from the coast and topographical conditions that permitted only transport by pack animals protected them from the plague.

The nomadic and semi-nomadic populations of the desert suffered much less from the plague than the sedentary population. Their grazing lands could not support a large and crowded population. As Conrad has shown, the nomads were aware of the danger of being infected by the sick, and viewed the cities as sources of pollution and disease (Conrad 1981, 467-468). Since the nomads lived in open areas with a scattered population, they were minimally affected by the plague. Their inland location far from the coastal cities delayed the arrival of the epidemic, and when it did arrive it was past its peak. The nomadic population lived in tents or in light and thinly distributed stone structures. They were accustomed to migration and knew how to find food and shelter in the open, unlike the inhabitants of the towns and villages. Natural selection was in their favor and enabled them to penetrate the vacuum created by the plague among the sedentary population.

The nomadic and semi-nomadic population in the arid areas of the Negev,

Jordan and southern Syria subsisted from a local economy that was largely based on herding. The interaction between them and the neighboring sedentary population that was less affected by the plague created an autonomous economy that may provide an explanation of the flourishing of settlement in these areas in the Umayyad period. The ravages of the plague in other areas probably led to a rise in the prices of basic commodities. As a result, the inhabitants of less severely affected regions would have enjoyed higher profits and a rise in their standard of living.

The effects of the plague were far-ranging. Apart from the immense mortality, direct effects included famine and devaluation of the currency. Another effect was the widespread abandonment of land and the migration of desperate peasants to the cities. In other places, desperate urban residents left the city for the countryside from fear of the plague. Another casualty of the plague was the army: the disease ran like wildfire through the barracks and drastically thinned the ranks of the troops (Teall 1965, 307). However, it should be noted that the Persian army fared no better. The high mortality among young men severely affected recruitment. The settlement vacuum created by the plague enabled the penetration of barbarians from beyond the Empire's borders: Avars, Slavs and Arabs.

## CONCLUSIONS

The plague struck all the cities of the Mediterranean, mostly in the eastern parts of the Empire but also in the West. Everywhere it caused a significant reduction in the population and led to widespread abandonment of agricultural lands. Arable farming was more severely affected than herding. International trade declined and local trade was restricted. The plague brought about a crisis in trade and security. The reduction in population caused a crisis in military recruitment, resulting in a lawlessness on the

roads and a general lack of security. These conditions apparently enabled violent attacks on remote settlements like En-Gedi, Mamphis and Petra, leading to their abandonment.

The combination between the plague pandemic and the drought conditions caused by the fall in rainfall was particularly damaging. The combination led to a collapse, albeit gradual, of the economy that was based on trade and urban services. Thus two of the outstanding achievements of the Roman Empire - trade and urbanism - proved to be

vulnerable and led to its downfall.

In contrast, the nomadic and semi-nomadic populations on the periphery were much less severely affected. Their pastoral economy was viable even in the arid conditions of the desert. The plague was concentrated in populated areas and its influence was less critical in remote areas. The vacuum caused by the plague was filled by peripheral populations such as the Arabs from the Arabian peninsula and the Avars and the Slavs from northeast Europe.

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