# 2 · *Near Eastern Civilizations*

## The Early Cultures of the Near East

The term the Near East (or Middle East) covers the region from Anatolia and the Caucausus in the north, the eastern Mediterranean coast to the west, Iran to the east, and Arabia to the south. The Levant refers to the lands along the coast of the eastern Mediterranean, while Mesopotamia was located in the region of modern-day Iran and Iraq. The Near East region is sometimes described as the cradle of human civilization, as this was the area where agriculture was first developed, leading to the first permanent settlements and later towns and cities, the first writing systems and alphabet, the first known currency, and the invention of the wheel.[1] If it is possible to define what is, and is not, a civilization, it could be argued that the early peoples with an increasingly complex and inter-networked society in this region from the fifth millennium BCE onwards may be reasonable candidates.[2] However, here we describe the changing Near East as a continuous process, to help set the scene for the later discussion of parasites in the region.

Prior to about 10,000 BCE the people living in the Near East appear to have found their food hunting wild animals, catching fish, and gathering plants. Around 10,000–9000 BCE we see evidence for cultures where cereal grains were ground and consumed. They also learned to herd sheep, goats, and cattle.[3] This was the start of the Neolithic period. The most heavily populated areas were those with better water resources, often termed the fertile crescent. The creators of early settlements tried out different designs for buildings, villages, towns, and defences until they worked out an efficient approach. They started to herd animals, and learn how to plant, harvest, and store a range of crops. Pottery was developed to both store and cook food. The Copper Age, when this metal was first smelted, is known as the Chalcolithic period (4500–3300

[1] Bourke (2018). [2] Wengrow (2010). [3] Wengrow (2010, p. xii).

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BCE). In the early Chalcolithic the Ubaid culture flourished in Mesopotamia where they built extensive canal networks for irrigation, while in the late Chalcolithic we find the Sumerian Uruk period, when cuneiform writing developed. The Early Bronze Age spanned from 3300 to 2011 BCE, a time when the Phoenicians settled along the Mediterranean coast, there was the Early Dynastic Period of Sumer, and then the Akkadian Empire. The Middle Bronze Age covers 2100–1550 BCE, when we see the Third Dynasty of Ur, early Babylonia, and later the Hittite Old Kingdom. The Late Bronze Age spanned from 1550 to 1200 BCE, characterized by the Hittite Middle Kingdom and the Middle Elamite Period, then the Hittite New Kingdom and the rise of Ugarit, followed by the Middle Assyrian Empire and the start of the zenith of the Phoenicians.[4] The Iron Age covers 1200–539 BCE, the time of Troy, Neo-Hittite states, Aramean states, the Kingdoms of Israel and Judah,[5] the Neo-Assyrian Empire, then the Neo-Babylonian Empire, the Median Empire, Phoenicia, and the rise of Archamenid Persia.[6] Classical antiquity (539 BCE–634 CE) spans the Seleucid Empire, Macedonia Empire, Parthian Empire, then the expansion of the Roman Empire and subsequent Byzantine Empire.[7] In the 630s CE the Muslim conquests took place, which swept across the Near East and North Africa.[8]

## Helminths

### Early Prehistoric Villages

The earliest evidence for parasite infection in the Near East is from the site of Shillourokambos on the island of Cyprus. This settlement dates from 7800 to 7300 BCE, during the pre-pottery Neolithic period. Food identified at Shillourokambos included cereal grains (wheat), legumes (peas, lentils), and the bones of pig, deer, cattle, sheep, and goat. Pelvic sediment was taken from five burials at the time of their excavation. Four of the of the five were positive for parasite eggs, with three having whipworm (*Trichiuris trichiura*), two having roundworm (*Ascaris lumbricoides*), two having *Taenia* sp. tapeworm, and one having *Fasciola* sp. liver fluke.[9] A further component of the same study involved analysis of

[4] Buck (2020); Düring (2020). [5] Matthews (2018); Schipper (2019). [6] Briant (2002).
[7] Fisher (2020). [8] Bourke (2018); Van der Mieroop (2016).
[9] Harter-Lailheugue et al. (2005).

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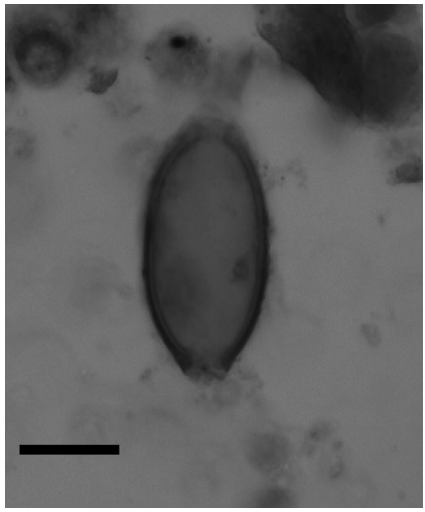

*Figure 2.1.* Whipworm egg from neolithic Çatalhöyük, Turkey (image credit Evilena Anastasiou). Black bar indicates 20 μm.

burials from nearby Khirokitia, dating from the seventh millennium BCE. Food identified at Khirokitia included cereal grains (wheat and barley), legumes (lentils and peas), pistachio nuts, figs, olives, plums, and the bones of sheep, goat, and deer. Pelvic sediment from seven burials was analysed. One individual was positive for whipworm, roundworm, and *Taenia* sp. tapeworm, while the other six were negative for parasites.[10] When we consider the evidence from both these sites, we can see that these early farmers ate a mixture of crops, farmed animals, and wild game. Of the 12 individuals tested, half were positive for intestinal parasites. It seems to have been common for those who were infected to have had multiple species cohabiting within their intestines.

Çatalhöyük was an early town located in the southern part of Turkey, in use from 7100 to 6150 BCE. Four coprolites dating from 6410 to 6150 BCE were recovered from a midden (rubbish dump) on the East Mound of this settlement. Bile acid and sterol analysis confirmed they were of human origin and not from animals. They were analysed for intestinal parasites and two were positive for whipworm eggs, at low egg counts (Figure 2.1). A further six human burials dating from 7100 to 6300 BCE underwent analysis of their pelvic sediment, but no evidence for parasite

[10] Harter-Lailheugue et al. (2005).

eggs was found in those samples.[11] This could indicate that the individuals were not infected by parasites, or that coprolites preserved parasite eggs better than did sediment from the pelvic region.

Plant foods identified at Çatalhöyük were dominated by cereals (wheat and barley), but with legumes, fruit, and nuts also consumed.[12] Animal foods were dominated by sheep and goats, but with cattle eaten at feasts, and some consumption of wild deer, wild horse, birds, wild pigs, and small freshwater fish.[13] However, there was no evidence for the eggs parasites spread by eating the meat of these animals, such as beef tapeworm, pork tapeworm, or fish tapeworm. We know that *Taenia* tapeworm was present in the region at the time, as they have been identified in nearby Cyprus in 7800–7300 BCE.[14] Therefore, their absence at Çatalhöyük may indicate that the population cooked their meat thoroughly, which kills off the *Taenia* parasite and prevents infection.

Whipworm is spread by the contamination of food or drink with human faeces. As the latrine was only invented in Mesopotamia in the fourth millennium BCE,[15] we might expect faecal contamination of living spaces to be a significant problem in early towns. However, the archaeologists excavating the houses at Çatalhöyük noted how they were much cleaner than they expected, with very little evidence for rubbish and waste. They seem to have been swept regularly, with the floors and walls replastered on a seasonal basis.[16] This focus on hygiene by the inhabitants may potentially explain why so few species were present in these samples, and why the whipworm that was found was at low egg count.

Tell Zeidan was an early farming settlement on the Balikh River in the Euphrates river valley of Syria, populated from 5800 to 4000 BCE. Pelvic sediment was analysed from 26 individuals dating from 4500 to 4000 BCE (Chalcolithic period). One individual was found to be positive on microscopy for a terminal-spined schistosome, likely *Schistosoma haematobium*.[17] This diagnosis of schistosomiasis was subsequently confirmed using aDNA analysis at an independent lab. Domesticated wheat and barley were grown at Tell Zeidan, despite its location in a climate too arid to support those crops.[18] This suggests that the farmers used an

[11] Ledger et al. (2019a). [12] Bogaard et al. (2013, 2017); Ryan (2008).
[13] Bogaard et al. (2013); Russell et al. (2013); Van Neer et al. (2013).
[14] Harter-Lailheugue et al. (2005). [15] McMahon (2015).
[16] Matthews (2005); Matthews et al. (2014). [17] Anastasiou et al. (2014).
[18] Smith et al. (2015).

irrigation system such as floodwater recession agriculture.[19] Crop irrigation was a technology first invented by the people of the Middle East from about 7500 BCE.[20]

Schistosomiasis is typically found in modern populations in the Middle East and Africa who wade in warm freshwater reservoirs or irrigation channels. The intermediate form of the parasite leaves its water snail host and burrows through the skin of the person becoming infected. After migrating through the body, the male and female worms mate in the blood vessels on the wall of the bladder and kidneys (in the case of *Schistosoma haematobium*). This causes inflammation and blood to be lost in the urine. There the worms release their eggs into the urine, and if this happens in freshwater the parasite passes into *Bulinus* sp. water snails, and the life cycle is completed.[21] The shells of *Bulinus* snails have been found during excavation of ancient sites across the Middle East, and early medical texts from Assyria mention that some diseases of the time caused red urine, presumably due to blood.[22]

It has been suggested that in biblical times schistosomiasis was spread from Egypt to Jericho in the Levant, explaining the 'curse of Joshua'.[23] The biblical account states that Joshua captured the city after the Israelites exodus from Egypt. The city walls fell as his army marched around the city blowing their trumpets. He then cursed Jericho: 'May the Lord's curse light on the man who comes forward to rebuild the city of Jericho'.[24] However, more recent scholarship has concluded that the conquest narratives found within the book of Joshua do not have historical reliability, as the text was written centuries after the events described within it.[25] The origin of the Israelites seems to have been in the Iron Age villages of the Levant, without any period of slavery in Egypt, nor a mass exodus from Egypt.[26] There is no reason to believe that these events ever took place. Furthermore, as the earliest evidence for schistosomiasis currently identified comes from Mesopotamia, and as that evidence pre-dates the rise of ancient Egypt, a hypothesis involving the spread of schistosomiasis from Egypt seems highly unlikely and unnecessarily complicates the issue. It is likely that by the biblical period schistosomiasis was widespread across all areas of the Middle East where crop irrigation was employed, explaining its presence in both Mesopotamia and ancient Egypt.

[19] Stein (2011); Wilkinson (1998). [20] Helbaek (1972); Oates (1973). [21] Gryseels (2012).
[22] Adamson (1976); Bergquist et al. (2017); Hulse (1971).
[23] Hulse (1971); Di Bella et al. (2018). [24] Joshua, 6: 26. [25] Killebrew (2005).
[26] Davies (2015).

### Bronze Age Civilizations

Shahr-e Sukhteh is located in south-eastern Iran. This Bronze Age cemetery dates from 3200 to 1800 BCE, and is thought to contain as many as 40,000 burials. The pelvic soil of 320 burials were analysed for the eggs of intestinal parasites, and one was found to be positive. Six eggs of *Physaloptera* sp. were identified in an adult male dating to 2800–2500 BCE.[27] This nematode worm normally infects a range of animals, rather than humans. However, humans can contract the parasite if they eat the insect intermediate hosts, which include crickets, cockroaches, and beetles. Infection is termed spiruridiasis. While it is not possible to tell if the insect consumption was deliberate (as food), or accidental (perhaps if mixed in with plant foods), we should bear in mind that insect consumption could have been more common in the Bronze Age than we might think. The extremely low proportion of the population with a positive result for parasite eggs is more likely to indicate poor preservation of eggs at the site than the vast majority of individuals being free from infection.

### Achamenid Empire

The salt mines at Chehrabad are located in north-west Iran, and their excavation has shown they were in use from 500 BCE to 500 CE. This covers the Achamenid to the Sassanian periods. The mine was located in a semi-arid region, with three seasonal streams to provide water for part of the year.[28] Sediment and coprolites from the mine contained the eggs of human pinworm, horse pinworm (*Oxyuris equi*), whipworm, roundworm, Lancet liver fluke (*Dicrocoelium* sp.), and either the human tapeworm *Taenia* sp. or dog tapeworm *Echinococcus* sp., which appear identical on microscopy. It is likely that these parasites came from the faeces of humans and pack animals (horses) that worked in the mine.[29]

The naturally mummified bodies of five miners killed in separate roof collapses were also recovered, and two underwent intestinal parasite analysis. One mummy was negative for parasites, but the other (radiocarbon dated to 286 BCE ± 28 years, calibrated) was positive for the eggs of *Taenia* sp. tapeworm (potentially beef tapeworm, pork tapeworm, or Asiatic tapeworm).[30] The high salt content of the soil in the mine preserved both

[27] Makki et al. (2017). [28] Aali et al. (2012). [29] Nezamabadi et al. (2013a).
[30] Nezamabadi et al. (2011, 2013b).

the corpses and parasite eggs particularly well, enabling us to better understand intestinal infection in this unusual environment 2000 years ago. In humans, some of the parasites present were spread by faecal contamination of food and drink (roundworm, whipworm, pinworm), while others were spread by the consumption of raw or incompletely cooked meat (*Taenia* sp. tapeworm). In the pack animals, *Dicrocoelium* sp. is spread by horses eating grass that contain ants infected by the parasite, while horse pinworm is spread by the animals scratching their itchy anal regions against objects and each other.[31] It is likely that the semi-arid nature of the region, coupled with the presence of running water at only certain times of the year, meant that limited personal hygiene and opportunities for washing would have facilitated the transmission of faecally spread parasites.

## Iron Age Jerusalem

In the eighth to seventh centuries BCE, Jerusalem was located in the Kingdom of Judah. It became a client state of the Neo-Assyrian Empire and then Neo-Babylonian Empire before a revolt led to its destruction by the Babylonian's ruler Nebuchadnezzar in 586 BCE. Two carved stone toilet seats were recovered from the City of David, which lies just south of the Temple mount. The building in which they was found is dated to the Babylonian destruction of Jerusalem 586 BCE. Therefore, the toilet must have been in use during the last years of the Iron Age (1200–586 BCE) and during the actual siege. The material in the cesspit beneath one of the toilet seats was analysed for parasite eggs using microscopy. Two species were identified, whipworm and *Taenia* sp. tapeworm, with egg proportions of 85 per cent whipworm to 15 per cent tapeworm.[32]

A further cesspit dating from the mid-seventh century BCE has been excavated from Armon Hanatziv in southern Jerusalem. Remains of ornately carved columns, window frames, and balustrades suggest a high-status household from the time between the reigns of King Hezekiah and King Josiah. A stone toilet seat with holes cut for faeces and urine was recovered associated with a cesspit. Microscopy of the sediment from the cesspit identified the eggs of whipworm, roundworm, *Taenia* sp. tapeworm, and pinworm.[33]

[31] Taylor et al. (2015). [32] Cahill et al. (1991). [33] Langgut (2022).

### The Dead Sea Scroll Sect at Qumran

The Essenes were a small Jewish sect who set up a monastic community on the western shore of the Dead Sea (Israel) from 100 BCE to 68 CE.[34] In 1947 a Bedouin shepherd discovered a jar of their manuscripts in a cave, and over time over 1000 such manuscripts have been recovered. These have been termed the Dead Sea scrolls.[35] The Essenes had strict regulations regarding when and how they should go to the toilet. For example, they were not to go to the toilet in the holy city of Jerusalem. The Temple Scroll states that, 'you shall make for them latrines outside the city where they shall go out, north-west of the city. These shall be roofed houses with holes in them into which the filth shall go down. It shall be far enough not to be visible from the city'.[36] The historian Josephus lived as a young man with the Essenes, and wrote about how they went to the toilet. 'They dig a trench a foot deep with a mattock ... and wrapping their mantle around them, that they may not offend the rays of the deity, sit above it. They then replace the soil in the trench. For this purpose, they select the more retired spots. And though this discharge of the excrements is a natural function, they make it a rule to wash after themselves, as if defiled'.[37]

Excavation of the site at Qumran has allowed assessment of some of the hygiene regulations of the Essenes. Areas suspected to be the location of such toileting practices were sampled for the eggs of intestinal parasites. The eggs of roundworm, whipworm, pinworm, and *Taenia* sp. tapeworm were identified. Although pig whipworm and pig roundworm produce eggs of very similar appearance to the forms that infect humans, because this Jewish sect forbade the presence of pigs it is highly likely that the eggs identified were the species that infect humans (*A. lumbricoides* and *T. trichiura*). Similarly, the *Taenia* sp. tapeworm is likely to represent beef tapeworm (*T. saginata*), as cattle bones were found during the excavation and the Essenes would not have consumed pork so would not have been infected by the pork tapeworm, *T. solium*.[38] It does appear that the parasites that infected those Essenes living at Qumran were mostly those spread by faecal contamination of food, drink, and hands (roundworm, whipworm and pinworm), with some infection from eating undercooked beef (beef tapeworm). In the arid conditions of the Judean Desert where it borders the Dead Sea, fresh water for washing

[34] Amihay (2017); Taylor (2012). [35] Ulrich (2015); Eshel (2015). [36] Vermes (1997).
[37] Josephus, Flavius (1976). [38] Harter et al. (2004); Zias et al. (2006).

was only available for a few months in the winter. Their cisterns and ritual bathing pool would then have to store the water they needed for the rest of the year.[39] This would explain how parasites associated with limited hygiene would have thrived. Similarly, the scarcity of firewood in the desert may have made it difficult to cook beef thoroughly, and so allowed the spread of beef tapeworm in the monastery at Qumran.

## Ectoparasites

Nahal Hemar Cave is located on the southern edge of the Judean Desert in Israel, 15 km west of the Dead Sea. Human hair was found in the cave, along with ritual objects such as figurines, stone masks, modelled skulls, knives and an anthropoid statue. No burials were found in the cave. The assemblage has been radiocarbon dated to 6900–6300 BCE (uncalibrated). The hair was analysed using microscopy and three eggs (nits) of the human head louse (*Pediculus humanus capitis*) were identified.[40] This is the earliest evidence for ectoparasites in populations from the ancient Near East.

The Jewish fortress of Masada, in the Judean Desert near the Dead Sea, was originally built during the reign of King Herod the Great. At the time of the First Jewish Revolt against the Romans (66–73/74 CE), Masada was defended by Jewish soldiers. They were the last stronghold to face the Romans, and chose collective suicide rather than a life of slavery when the fortress fell. One building was identified as used by Jewish rebels from the presence of Jewish coins, and ostraca in Aramaic and Hebrew. Textile fragments recovered from this room at excavation were cleaned and the debris studied using microscopy, when the fragments of body louse (*Pediculus humanus humanus*) were identified.[41]

Twenty-four hair combs were recovered from further excavations in the Negev Desert and Judean Desert in Israel. They dated from the first century BCE to the eighth century CE. Most combs were two-sided and made of wood. One side had their teeth spaced well apart to untangle knots in the hair, while the other side had very fine, closely packed teeth to strip the head lice and eggs (nits) from the hair.[42] Twelve of the 24 combs were found to have the eggs of head lice caught in the fine teeth of the combs.[43]

[39] Hirschfeld (2004); Magness (2002). [40] Zias and Mumcuoglu(1991a).
[41] Mumcuoglu et al. (2003). [42] Mumcuoglu and Zias (1989).
[43] Mumcuoglu and Zias (1988).

Two wooden combs dating from the Roman Period were excavated from the Cave of the Pool near the Dead Sea. Due to the other material recovered at excavation, they are thought to belong to members of the local Jewish population at En Gedi, and to date from the second century CE. One comb was single-sided and the other double-sided. The double-sided comb was found to have a head louse in the first nymphal stage trapped between the teeth.[44]

## Interpreting the Evidence

Over this 8000-year period, we can see that in the Near East the most successful intestinal parasites were whipworm, roundworm, and *Taenia* tapeworm. All three were found in prehistoric Cyprus, whipworm at Çatalhöyük, all three at the Chehrabad salt mines in Iran, all three in Iron Age Jerusalem, and all three in the Essenes at Qumran. While roundworm and whipworm are commonly found in early agricultural societies, the repeated presence of *Taenia* tapeworm in Near Eastern populations over time suggests that it was particularly suited to the climate and diet of the region.

The presence of schistosomiasis at Tell Zeidan during the Chalcolithic period appears to be the earliest evidence so far identified for the invention of a new technology by humans increasing the risk of spread of an infectious disease. Agricultural irrigation was first developed in the Near East around 7500 BCE, and these irrigation systems allow breeding of the water snails that can spread the schistosomiasis when people wade through areas of standing freshwater.

Pinworm was also found at the Chehrabad salt mines, Iron Age Jerusalem, and the Essenes at Qumran. The eggs of this parasite are fragile and only preserve in favourable conditions. It is quite likely that many societies in the ancient Near East were infected by pinworm, and that the available evidence is limited to those environments that favoured egg preservation.

Head lice and body lice were also present in the region, and head lice in particular seem to have been present from the earliest prehistoric populations there. The development of wooden delousing combs, coupled with the arid climate that preserved them, has resulted in a strong body of evidence for head lice and their eggs.

[44] Mumcuoglu and Hadas (2011).