



# THE TEN PLAGUES OF EGYPT



**Stephen Mortlock** asks if the 10 plagues of Egypt were the result of an ecological domino effect or divine intervention?

**A**s children, many of us will have read how the Hebrew people living in Egypt were suffering under the cruel rule of the Pharaoh. Moses asked the Pharaoh to let them return to their homelands in Canaan, but he refused. As a consequence, 10 plagues were inflicted on the Egyptians in a divine demonstration of power and displeasure designed to persuade the Pharaoh to reverse his decision. But were the plagues historical events or, as some historians have suggested, simply passed-down accounts of several natural disasters? Some scholars concede that from an historical standpoint, the first nine plagues resemble natural events and while some are disconnected, others appear to be part of a chain reaction with set patterns and a rapid succession. The Egyptians were renowned for recording every event, whether temporal or religious in nature, but there are few references to plagues in ancient Egyptian literature. What if the plagues, however, involved villages and the countryside around Goshen,

these might not have been referred to the royal court for insertion in official chronicles.

### Recording history

When did the plagues occur and who was the tyrannical Pharaoh? The Greek historian Herodotus put the dates around 1570-1550 BC when Egypt was under the rule of the Hyksos (an Asiatic tribe), but there was no Pharaoh, until Ahmose I (1550-1525 BC) raised rebellion and overthrew the invaders. During this time apocalyptic rainstorms, devastated much of Egypt, and were described on the Tempest Stele of Ahmose I, these have been attributed to short-term climatic changes caused by the Thera volcanic eruption on the island of Santorini around 1630 BC (although it has also been suggested that the storm reference is merely a metaphor for the chaos caused during the war). Trevisanato (in his 2005 book *The Plagues of Egypt: Archaeology, History, and Science Look at the Bible*), suggested this eruption was also the trigger event for the plagues. There are indications that the environmental effects of this



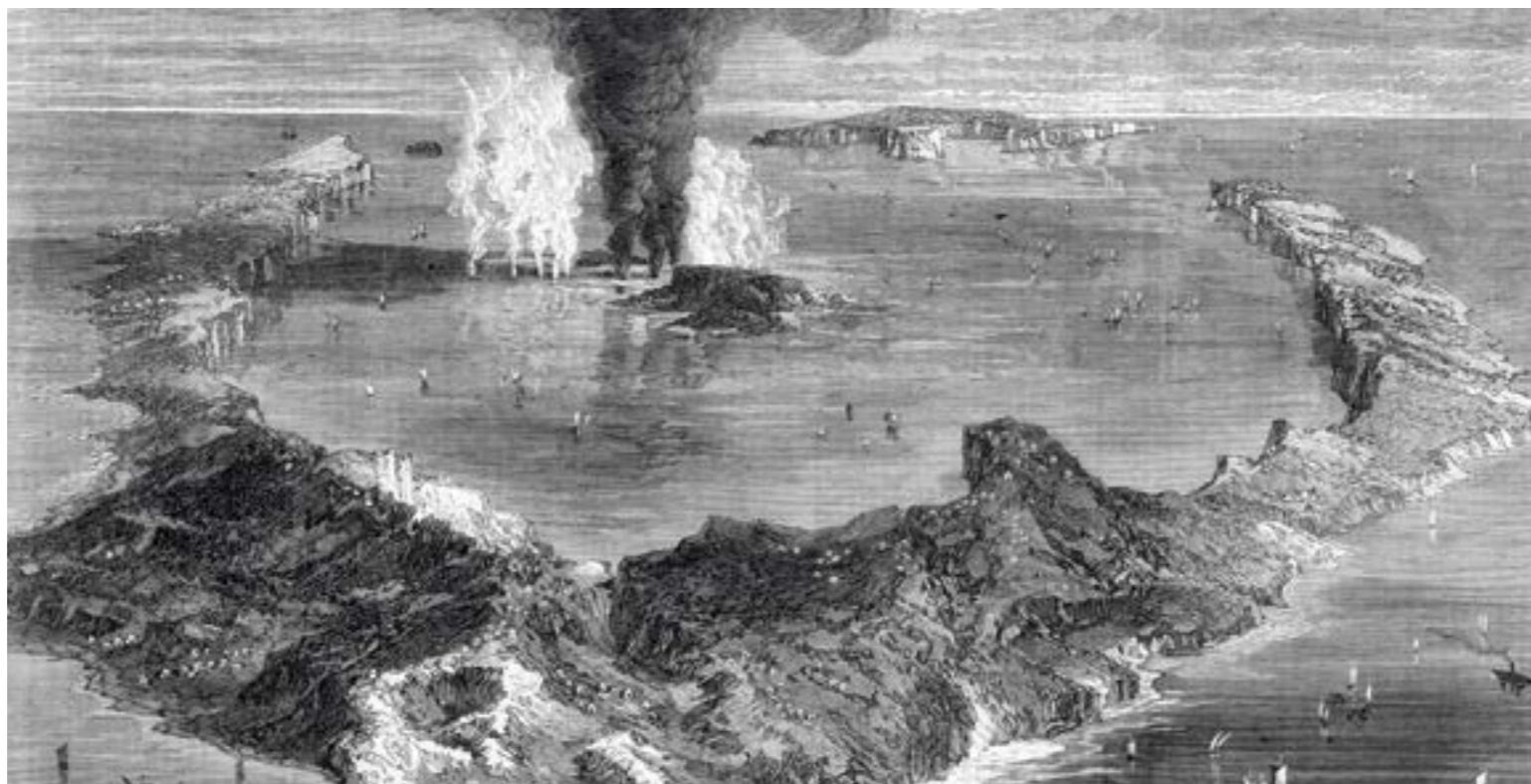
**Right.** A volcano erupting on the Greek island of Santorini (Thera, Thira), thought by some to be the location of Atlantis. Date: 1866

eruption were felt around the globe – some scholars have also linked this eruption to the legend of Atlantis. Trevisanato believes that volcanic ash tainted the Nile causing it to become acidic and sediments found at the bottom of lakes along the Nile Delta seem to suggest that there was deposit of volcanic ash sometime during the Middle Bronze Age, which would be in line with the eruption on the Greek volcanic island. In a pre-industrial ancient Egypt, sulphates from a massive volcanic fall out would provide the simplest and most plausible scientific explanation for this contamination. A red, acidic Nile would have killed the fish, kept people from drinking from the river and, according to contemporary records, caused burns which later became infected with 'larvae'.

However, Alfred Edersheim proposed in his *Old Testament Bible History* that Thutmose II (1509-1479 BC) may have been the protagonist. In 1886 when the mummy of Thutmose II was unwrapped by Gaston Maspero there were scars from some type of infection which were still visible even after being embalmed. Maspero described the mummy as being "scabrous in patches, and covered with scars". Lesions covered the back, waist, arms and legs of the body and there was a mixture of papules, scabs and scars. Had Thutmose II died of a disease spreading through the region at that time? Evidence exists that the Queen's nanny, Sitre In, suffered from a similar condition. The details are very similar to descriptions of the 6th plague where "boils burst forth upon man and beast throughout the land of Egypt!" (Exodus 9.9).

### A red river

Another candidate for the Pharaoh is Ramesses II (1303 - 1213 BC), made popular by the Hollywood epic *The Ten Commandments*. At this time the climate of the capital city Pi-Ramesses was wet and tropical, but towards the end



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of his reign the climate became dry and more desert-like. This change has been confirmed by a study of the stalagmites in local Egyptian caves, which have provided a record of the weather patterns of the time. It is possible that the Nile turned from a swiftly flowing river into a sluggish, muddy watercourse due to the rising temperatures and arid conditions.

This was the basis of the 1950s naturalistic theory by Greta Hort, who proposed that certain algae in particular, *Haematococcus pluvialis* and *Euglena sanguinea*, were able to flourish in these conditions. The red colour is due to the presence of astaxanthin and under the right

conditions the cells can be populous enough to turn water red. *Euglena sanguinea* is also known to produce the potent ichthyotoxin euglenophycin. The idea of an algal bloom is also proposed by Dr Stephan Pflugmacher, who believes that when the Nile changed it allowed the toxic algae *Planktothrix rubescens* to thrive in the warm slow moving water. When the algae died it turned the water red causing a phenomenon called "Burgundy blood". Dr JoAnn Burkholder has cited a similar condition in North Carolina in 1996 but caused by *Pfiesteria piscidia*. So there is recorded evidence for this type of event. The ancient historian Josephus Flavius reported that the blood red water was

undrinkable, the fish died and the air was filled with a horrid stench. Algal blooms can be harmful to wildlife, as the algae contain a toxin that can accumulate in shellfish and poison the animals that feed on them. Fumes from densely-concentrated algal blooms can also disperse toxins in the air, causing breathing problems for people. More importantly, a bloom in the water would have killed the fish, allowing amphibians to breed unchecked, as fish eat their eggs. Studies have also shown that tadpoles, when stressed because of a change in their environment, quickly develop into frogs. The toxic water would have caused the amphibians to leave and swarm over the land in overwhelming numbers. The amphibians would have stayed away from the deadly river and many would have died, leading to the third plague – lice (this could mean lice, fleas or gnats, based on the Hebrew word *kinnim*).

IMAGES: ALAMY

If toxic algal led to the first plague and dead frogs followed, it is not surprising that a swarm of insects would also follow.

### The plagues continue

The lack of frogs in the river would have let insect populations, normally kept in check by the frogs, increase massively. The rotting corpses of fish and frogs would have attracted significantly more insects to the areas near the Nile. If so, an infestation with certain insects could have set the stage for the later plagues. Scientists have theorised that the sickness that killed the beasts of the field for Egyptians in later plagues might have been Bluetongue or African horse sickness (AHS), these are *Orbiviruses*, of the *Reoviridae* family, both of which can be spread by insects of the *Culicoides* species. Marr and Malloy argued that the fourth plague represents a swarm of flies, such as the stable fly (*Stomoxys calcitrans*). Studies have shown that cattle heavily infested with stable flies can become anaemic and have lower milk yields. The stable fly also bites humans and could have led to the boils that occurred as part of the sixth plague. In many parts of the world, the species is a carrier of trypanosomid parasites including *Trypanosoma evansi* and *Trypanosoma brucei*. There would have also been an increase in the common house fly (*Musca domestica*), which belongs to a group of flies often referred to as "filth flies". The house fly has been in existence since the origin of human life, is well adapted to life in human habitations and acts as a potential vector of diseases. A recent study found that over 100 pathogens including bacteria such as *E. coli* and *S. aureus*, viruses, fungi and parasites have been associated with this prolific insect, so it is not surprising that people would have been suffering from increased illnesses. Could the boils have been caused by *S.aureus*?

The fifth plague, which killed off the Egyptian livestock, has similarities of rinderpest, a member of the genus

## THE 10 PLAGUES IN THE BOOK OF EXODUS

**01 Blood**  
The waters were turned to blood – the fish in the river died and the Egyptians couldn't drink the foul water.

**02 Frogs**  
Frogs swarmed forth, covering every inch of land and entering houses and bedrooms.

**03 Lice**  
All over Egypt, bugs crawled forth from the dust to cover the land.

**04 Wild animals**  
Hordes of wild animals destroyed everything in their path.

**05 Pestilence**  
A fatal pestilence killed most of the domestic animals of the Egyptians.

**06 Boils**  
The Pharaoh, his servants, the Egyptians and even their animals developed painful boils all over their bodies.

**07 Fiery hail**  
Hail struck down all the crops in the fields and shattered every tree.

**08 Locusts**  
The locusts covered the face of the land and swallowed up every crop and all the fruits of the trees.

**09 Darkness**  
A thick darkness over the land of Egypt, so total that the Egyptians had to feel their way around.

**10 Death of the first-born**  
All firstborn Egyptian sons (and firstborn cattle) died. Israelites marked lamb's blood above their door and were passed over.





**Below.** Death of the firstborn of Egypt – last of the ten plagues. Exodus, chapter XII

*Morbillivirus*, a member of the *Paramyxoviridae* family. This causes high fever, diarrhoea and ulcers in the mouths and noses. Rinderpest is spread between animals by direct contact and possibly aerosol over limited distances. The virus can be spread via secretions from the eyes, nose, or mouth, and the faeces, urine, blood, milk, or reproductive fluids of infected animals.

Then, around 1600 BC, the plume of another Santorini eruption may have been responsible for the seventh, eighth and ninth plagues – the fiery hail, the locusts and the days of darkness. According to the archaeologist Charles Pellegrino, the Santorini eruptions would have been comparable with the Mount St Helens eruption of 1980 and this volcanic plume coupled with high velocity dust storms could have rained down in Egypt, thereby turning days into nights and causing weather anomalies with increased precipitations and higher humidity. It is possible that when the volcanic ash mixed with thunderstorms above Egypt, it led to dramatic hailstorms. This could have created the conditions which caused the infamous desert locust (*Schistocerca gregaria*) to change from the solitary to the more gregarious form, not only are they more sociable they change in appearance, becoming stronger, darker in colour and more mobile. They can swarm over long distances and, according to the United Nations Food and Agricultural Organization, when they get hungry, a one-tonne horde of locusts can eat the same amount of food in one day as 2,500 humans. Such a pestilence would devour all the remaining plants that the hail did not destroy.

Archaeologists have always believed that the last plague, the death of the firstborn male, was caused by wheat infected with a fungus. But this seems unlikely, since infants died also and they would probably not have been eating grain. Also, why




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were some children spared? There is a similar historical precedent where ergot fungi (*Claviceps purpurea*), infected rye grain, and is believed to have precipitated the Salem witch trials in the winter of 1692 where it may have been the cause for the hallucinations, trances, seizures, and violent behaviours that were the supposed signs of being a witch. Although ergot did not cause death in the settlers, it is unclear why it affected some people and not others. A similar fungus could have infected the Egyptian grain.

### Conclusions

Were the plagues an ecological domino effect or divine intervention? It is very easy to dismiss the plagues as a fable when confronted with natural events such as volcanic eruptions, thunder, and desert

sandstorms driving locusts into Egypt. But there are many problems with trying to analyse historical events from contemporary records. Often it is difficult to work out where or when they happened. In this instance, the period for the plagues of Egypt is sometime between the years 1570 and 1440 BC, depending on who was writing about them. Eusebius Pamphili (263-339 AD), the first Church historian, believed the specific date to be 1446 BC. And yes, there were the Thera volcanic eruptions in around 1630-1600 BC, one of which is described as the largest on record, but it was 1,050 kilometres (650 miles) away from the northwest part of Egypt. And the eruption was many years before the Exodus took place; the eruption would only have caused some of the plagues, if one or other of the dates is wrong. I am not a theologian and rely on empirical evidence to make decisions, but occasionally there is a question where you ask: “What if?” 

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