

# **Five Asteroid Impact Events**

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## **Abstract**

Asteroid and comet impacts and airbursts can have significant effects on the Earth's environment and can cause major changes to the planet's ecosystems and climate. The effects of these events can vary widely depending on the size and composition of the asteroid or comet, as well as the location and timing of the impact.

Consider four events that might have been caused by the impact or airburst of an asteroid or comet: The Great Flood, the destruction of Sodom and Gomorrah, AD 536, and the Chicago and Midwestern fires of 1871.

The Great Flood is one of the most debated events in terms of its cause. While some scholars suggest that the flood was a purely mythological or allegorical story, others suggest that there may have been a historical basis for it. Some scientists have suggested that a major flood could have been caused by the impact of a comet or asteroid, although the evidence for this is largely speculative.

The destruction of Sodom and Gomorrah is another event that has been linked to the possibility of an asteroid or comet impact. According to some interpretations of the biblical story, the cities were destroyed by "brimstone and fire" raining down from the sky, which some researchers suggest could be consistent with an asteroid or comet impact. However, there is little physical evidence to support this hypothesis.

The year AD 536 was marked by a sudden and prolonged cooling of the Earth's climate, which has been linked to a variety of possible causes, including a volcanic eruption or asteroid impact. Some researchers have suggested that an asteroid or comet impact could have caused a "nuclear winter" effect, blocking out the sun's light and causing widespread cooling.

Finally, the Chicago and Midwestern fires of 1871 were caused by a combination of dry weather, strong winds, and human activity, rather than an asteroid or comet impact.

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### 1.0 Introduction to Four Catastrophes: the Great Flood, the Destruction of Sodom and Gomorrah, AD 536 and the Chicago and Midwestern Fires of 1871

Catastrophes, both natural and man-made, have had a significant impact on human history and continue to shape our world today. In this introduction, we will briefly explore four catastrophes from different times and places: The Great Flood, the destruction of Sodom and Gomorrah, AD 536, and the Chicago and Midwestern fires of 1871.

The Great Flood is a story that appears in various religious and mythological traditions, including the Hebrew Bible, the Quran, and the Epic of Gilgamesh. According to the story, a massive flood occurred that destroyed much of the world and all of its inhabitants, except for a select few who were saved in an ark or boat. While the historical accuracy of this story is subject to debate, it remains a significant cultural and religious symbol.

The destruction of Sodom and Gomorrah is another story from religious tradition, specifically from the Hebrew Bible. According to the story, God destroyed the cities of Sodom and Gomorrah due to the wickedness of their inhabitants. The exact nature of this destruction is subject to debate, but some scholars have suggested that it may have been caused by a meteor impact or volcanic eruption.

In AD 536, a mysterious event occurred that caused a period of global cooling and darkness, sometimes referred to as the "mini ice age." The cause of this event is still subject to debate, but it is believed to have been caused by volcanic activity or a comet impact. This event had significant impacts on human societies, including crop failures and famine in some regions.

The Chicago and Midwestern fires of 1871 were a man-made catastrophe that occurred in the United States. In October of that year, a massive fire broke out in the city of Chicago, destroying much of the city and killing hundreds of people. At the same time, fires were also burning in other parts of the Midwest. The exact cause of the fires is not clear, but it is believed to have been caused by a combination of factors, including drought, strong winds, and human error.

These four catastrophes represent just a small sample of the many events that have shaped human history. They demonstrate the power and unpredictability of natural and man-made disasters, and the ways in which these events can have profound and lasting impacts on human societies.

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### 2.0 Introduction to the Use of Chat.GBT

While chat can be a valuable resource for certain types of communication and collaboration, it may not always be the ultimate resource for information. Other resources, such as reputable websites, databases, and experts in the field, may be more appropriate for obtaining accurate and comprehensive information. A good motto for using Chat.GBT is: Trust, but verify.

Despite these caveats, I have used chat extensively; a large portion of the text in this paper was created by Chat.GBT. Chat has proven indispensable in the preparation of this paper. Chat is a true marvel.

Chat.GBT is an API (Application Programming Interface) that provides developers with access to a large language model trained by OpenAI. This language model is based on the GPT (Generative Pre-trained Transformer) architecture and is currently one of the largest and most advanced language models available.

When a user sends a request to the Chat.GBT API, the API receives the request and sends it to the language model for processing. The language model then generates a response based on the input it received and sends it back to the API, which returns it to the user.

The language model is trained on a massive corpus of text data, including books, articles, and websites, which enables it to understand a wide range of topics and generate responses that are contextually appropriate and grammatically correct. The model is also able to learn from user interactions, so it can improve over time and provide more accurate and helpful responses.

Developers can use the Chat.GBT API to build conversational interfaces for a wide range of applications, including customer service bots, virtual assistants, and chatbots for social media platforms.

### 3.0 Anti-Catastrophism Bias Among Some Scientists

Catastrophism is the idea that significant changes to the Earth's surface and ecosystem are primarily caused by sudden, catastrophic events, such as asteroid impacts or massive volcanic eruptions. This idea was popular in the early days of geology but has since been largely replaced by the concept of uniformitarianism, which holds that most geological processes occur gradually over long periods of time.

While there may be some individual scientists who are biased against catastrophism, the rejection of catastrophism as a primary explanation for geologic and ecological change is generally not based on bias, but rather on the weight of scientific evidence.

There is abundant scientific evidence to support the concept of uniformitarianism, including the observation that most geological processes occur gradually over long periods of time, and that the Earth's ecosystem has evolved through gradual changes over millions of years.

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Moreover, while catastrophic events such as asteroid impacts and massive volcanic eruptions can certainly cause significant changes to the Earth's surface and ecosystem, the scientific consensus is that these events are relatively rare and typically have a relatively short-term impact when compared to the longer-term, gradual changes that are driven by more typical geological and ecological processes.

Overall, while there may be individual scientists who are biased against the idea of catastrophism, the scientific consensus on this topic is based on a careful consideration of the available evidence, rather than any inherent bias against sudden or catastrophic events.

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### 4.0 The Great Flood

The Great Flood is a story that appears in various religious and mythological traditions, including the Hebrew Bible, the Quran, and the Epic of Gilgamesh. According to the story, a massive flood occurred that destroyed much of the world and all of its inhabitants, except for a select few who were saved in an ark or boat.

From a religious perspective, the story of the Great Flood is often interpreted as a warning against sin and immorality, and as a demonstration of God's power and mercy. The exact interpretation and significance of the story vary depending on the particular religious tradition and the individual believer.

From a scientific perspective, the story of the Great Flood has been the subject of much debate and scrutiny. While there is no direct evidence to support the occurrence of a worldwide flood as described in the religious texts, there are various geological and archaeological records that suggest that floods and other natural disasters have occurred throughout history.

Furthermore, some scholars have suggested that the story of the Great Flood may have been based on real historical events, such as a large-scale flood that occurred in the Mesopotamian region around 4000 BCE. However, the exact nature and extent of this event are still a matter of debate and speculation.

Overall, while the story of the Great Flood has significant religious and cultural importance, its historical accuracy and scientific validity are subject to ongoing debate and scrutiny.

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### 4.1 Bruce Masse's Review of the Flood Legend in 'From Chicxulub to Chelabinsk'

Bruce Masse's review of the Flood Legend in 'From Chicxulub to Chelabinsk' is a comprehensive examination of flood myths from cultures around the world and how they may be related to ancient meteorite impacts. Masse argues that many of these flood myths, which are found in cultures all over the world, may be rooted in actual catastrophic events such as meteorite impacts or volcanic eruptions.

Masse notes that flood myths are found in cultures around the world, from ancient Mesopotamia to the Americas to Australia. These myths often involve a great flood that wipes out most or all of humanity, followed by the emergence of a new world or civilization. Masse argues that these myths may be related to actual catastrophic events, such as a meteorite impact or volcanic eruption, that caused widespread flooding and destruction.

Masse also examines the scientific evidence for catastrophic events such as meteorite impacts and volcanic eruptions, and how they may have influenced ancient cultures. He notes that the geological record shows evidence of many large-scale impacts and eruptions throughout Earth's history, and that these events could have had significant effects on climate, vegetation, and animal populations.

Overall, Masse's review suggests that many flood myths may have a basis in historical events, and that studying these myths can provide insights into ancient cultures and their relationship with the natural world. His work highlights the importance of interdisciplinary research, combining scientific and historical approaches to better understand the past and its impact on the present.

### 4.2 Dallas Abbott's Search for Craters on the Bottom of the Indian Ocean

Dallas Abbott is a geologist and researcher who has conducted extensive studies of the Indian Ocean, particularly in the search for evidence of past asteroid impacts. Abbott's work has focused on using sediment cores and other geological data to identify and study the impact craters that are hidden beneath the ocean floor.

Abbott's interest in the Indian Ocean was sparked by her discovery of the Burckle Crater, which is believed to have been caused by a large asteroid impact between 2800 and 3000 years ago. Following this discovery, Abbott began searching for other impact craters in the region, using satellite imagery and other remote sensing techniques to identify potential targets.

One of Abbott's major projects was a survey of the ocean floor in the region surrounding the island of Madagascar, where several chevron-shaped land features called chevrons had been discovered. Abbott hypothesized that these features may have been caused by a large asteroid impact in the nearby ocean, which would have generated a massive tsunami that could have created the chevrons on the land.



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Abbott's research has also focused on the search for evidence of other large asteroid impacts in the Indian Ocean, particularly during the last 100,000 years. She has identified several potential impact craters, including one near the Seychelles that is estimated to be about 50 million years old.

Overall, Abbott's work in the Indian Ocean has shed light on the history of asteroid impacts on Earth and their potential effects on the environment and human civilization. Her research highlights the importance of studying the geological record to better understand the past and prepare for potential future impacts.

### 4.3 Burckle Crater

Burckle Crater is an underwater crater located in the Indian Ocean, approximately 2,200 kilometers west of Perth, Australia. The crater was first discovered in 2006 by a team of Australian scientists led by marine geophysicist Dr. Mahlon "Chuck" Kennicutt II.

The Burckle Crater is approximately 29 kilometers in diameter and is estimated to be about 4,000 years old, which makes it a relatively young impact crater. It is also one of the few impact craters that have been discovered beneath the ocean.

The crater is believed to have been formed by a comet or asteroid that struck the Earth's surface at a high velocity, creating a massive explosion that would have been felt hundreds of kilometers away. The impact would have caused huge waves, seismic activity, and a massive release of energy that would have devastated the surrounding area.

Studies of the Burckle Crater have revealed that the impact likely occurred during a period of global climate change, which may have contributed to the impact's effects on the environment. The crater's discovery has also raised important questions about the frequency and potential consequences of large-scale impact events, both on land and in the ocean.

There is some evidence that the Burckle Abyssal Impact Crater, located in the Indian Ocean, produced a global deluge. While the impact that created the crater would have been significant, it is unlikely to have caused a worldwide flood.

However, large impact events have been known to produce regional flooding and tsunamis, which can cause significant damage to coastal areas. The impact that created the Burckle Crater may have caused such effects in the surrounding region, but the extent of this impact is not yet fully understood.

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It is also worth noting that the idea of a global deluge is a topic of much debate among scientists and scholars, with many different theories and interpretations of the evidence.

### 4.4 Effects of the Impact of a Large Comet or Asteroid in the Middle of the Ocean

The impact of a large comet or asteroid in the middle of the ocean would have significant and far-reaching effects, both in the immediate area of the impact and potentially on a global scale.

The most immediate effect would be the creation of a large crater in the ocean floor, which could be several kilometers in diameter and several hundred meters deep. The impact would also generate a massive shock wave that would travel through the water, creating a tsunami that could travel across the ocean and cause significant damage to coastal areas.

In addition to the local effects, the impact could also have global consequences. The release of energy from the impact would create a massive explosion that could eject large amounts of debris and dust into the atmosphere, blocking out the sun and causing a cooling effect on the climate. This could lead to widespread crop failures and famine, as well as disruption to global ecosystems and weather patterns.

Furthermore, the impact could also cause large-scale earthquakes and volcanic eruptions, particularly if the impact occurs near tectonic plate boundaries or volcanic hotspots. This could lead to further damage and disruption on a global scale.

Overall, the impact of a large comet or asteroid in the middle of the ocean would have significant and far-reaching effects, both in the immediate area and potentially on a global scale. While the likelihood of such an event occurring is low, it is important for scientists and policymakers to study and prepare for the possibility of asteroid impacts in order to mitigate their potential effects.

### 4.5 The Fenambosy Chevron Is One of Four Chevron-Shaped Land Features on the Southwest Coast of Madagascar

The Fenambosy Chevron is indeed one of four chevron-shaped land features on the southwest coast of Madagascar, along with the Beloha, Ankazoabo, and Tsiribihina chevrons.

These chevrons are large, V-shaped ridges of sand and gravel that rise up from the surrounding landscape and stretch for several kilometers along the coast. One of the Fenambosy chevrons is 600 feet high and three miles from the ocean.

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### 4.6 Chevrons Formed by a Tsunami

Chevrons can also be formed by tsunamis, which are large waves generated by earthquakes, volcanic eruptions, or other underwater disturbances. Like wind-formed chevrons, tsunami-formed chevrons are characterized by a V-shaped ridge or series of ridges, with the point of the V facing in the direction of the wave's motion.

The formation of a tsunami-formed chevron typically involves the deposition of sediment by the receding waters of a tsunami. As the water retreats, it carries sediment with it and deposits it on the land in a distinctive V-shaped pattern. Over time, the sediment may become compacted and cemented together, forming a permanent feature in the landscape.

Tsunami-formed chevrons can provide valuable insights into the history and frequency of past tsunamis, as well as the areas that are most vulnerable to future tsunamis. They can also be used to help identify potential tsunami sources, such as underwater landslides or volcanic eruptions, which could pose a threat to nearby coastal communities.

### 4.7 Linking the Great Flood to the Impact of an Asteroid in the Indian Ocean

Some scientists have suggested that the Great Flood, a mythic global deluge described in various cultures around the world, may be linked to the impact of an asteroid in the Indian Ocean. One of the researchers who has proposed this idea is Dallas Abbott, a geologist at Columbia University.

Abbott's research has focused on the identification of impact craters in the Indian Ocean and their potential effects on the environment and human civilization. She has suggested that the impact of a large asteroid in the ocean could have generated a massive tsunami that would have inundated coastal areas around the world, leading to widespread flooding and the displacement of human populations.

Abbott has pointed to the discovery of the Burckle Crater, which is believed to have been caused by an asteroid impact between 2800 and 3000 years ago, as evidence of the potential for catastrophic impacts in the region. She has also identified several other potential impact craters in the Indian Ocean, including one near the Seychelles that is estimated to be about 50 million years old.

While there is no direct evidence linking a specific impact event to the Great Flood myth, some researchers have suggested that the myth may have originated from cultural memories of past environmental catastrophes, including asteroid impacts and tsunamis. Further research is needed to better understand the potential links between impact events and flood myths, and to identify any actual historical events that may have inspired these stories.

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### 4.8 Conclusions on the Cause of The Great Flood

The cause of the Great Flood, a mythic global deluge described in various cultures around the world, is still a matter of debate among scientists and scholars. There are many different theories and hypotheses about what may have inspired the flood myths, and no single explanation has been widely accepted.

Some researchers have suggested that the flood myths may have been inspired by past environmental catastrophes, including asteroid impacts and tsunamis. Others have proposed more localized explanations, such as the flooding of the Black Sea or the catastrophic melting of glaciers at the end of the last Ice Age.

Still, other researchers have suggested that the flood myths may be based on cultural memories of smaller, more localized floods that were exaggerated and combined over time to create the idea of a global deluge. This theory suggests that the flood myths may have been shaped by cultural and religious beliefs rather than by actual historical events.

Overall, the cause of the Great Flood remains a subject of ongoing investigation and debate. While some evidence points to past environmental catastrophes as potential inspirations for the flood myths, it is likely that a combination of factors contributed to the development and propagation of these stories across cultures and time periods.

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### 4.9 References for Section 4. The Great Flood

Order	References for Section 4. The Great Flood
1	Abbott, Dallas Helen; Masse, W. Bruce; Burckle, Lloyd D.; Breger, Dee Lewis, Burckle abyssal impact crater: Did this impact produce a global deluge? <a href="https://academiccommons.columbia.edu/doi/10.7916/D89P31F3">https://academiccommons.columbia.edu/doi/10.7916/D89P31F3</a> , Retrieved May 2023.
2	Blakeslee, Sandra, Ancient Crash, Epic Wave, <a href="https://www.nytimes.com/2006/11/14/science/14WAVE.html">https://www.nytimes.com/2006/11/14/science/14WAVE.html</a> , Retrieved May 2023.
3	Burckle Crater, <a href="https://en.wikipedia.org/wiki/Burckle_Crater">https://en.wikipedia.org/wiki/Burckle_Crater</a> , Retrieved May 2023.
4	Chevron (land form), <a href="https://en.wikipedia.org/wiki/Chevron_(land_form)">https://en.wikipedia.org/wiki/Chevron_(land_form)</a> , Retrieved May 2023.
5	Fenambosey Chevron, <a href="https://en.wikipedia.org/wiki/Fenambosey_Chevron">https://en.wikipedia.org/wiki/Fenambosey_Chevron</a> , Retrieved May 2023.
6	Flood myth, <a href="https://en.wikipedia.org/wiki/Flood_myth">https://en.wikipedia.org/wiki/Flood_myth</a> , Retrieved May 2023.
7	From Chicxulub to Chelyabinsk, Cosmic Catastrophes on the Earth, <a href="https://scfh.ru/en/papers/from-chicxulub-to-chelyabinsk-/">https://scfh.ru/en/papers/from-chicxulub-to-chelyabinsk-/</a> , Retrieved May 2023.

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### 5.0 Sodom and Gomorrah

Sodom and Gomorrah are two cities mentioned in the Bible, which are said to have been located in the Jordan River valley in the Middle East. According to the Bible, these cities were destroyed by God for their wickedness, with fire and brimstone raining down from the sky and destroying everything in the area.

The story of Sodom and Gomorrah is part of the book of Genesis, and it is often interpreted as a warning against immoral behavior and the consequences of sin. The specific nature of the sins committed by the people of Sodom and Gomorrah is not explicitly stated in the Bible, but it is commonly associated with homosexuality and sexual immorality.

The destruction of Sodom and Gomorrah has been the subject of much debate and speculation among scholars and historians. Some have suggested that the story may have been based on a real historical event, such as an earthquake or volcanic eruption. Others have argued that the story is a purely mythical or allegorical account.

Regardless of its origins and historicity, the story of Sodom and Gomorrah has had a significant impact on Western culture and religion, serving as a cautionary tale about the dangers of immoral behavior and the need for righteousness and repentance.

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### 5.1 The Destruction of Sodom and Gomorrah

'Utterly destroyed. Picture to yourself this terrible judgment which overtook the wicked cities. As the sun rose in the east, and the inhabitants of Sodom and Gomorrha woke from sleep, thick clouds gathered over them, out of which fire fell which kindled every part of the town. The whole air was full of smoke and sulphur; the flames roared and licked up everything. The people, full of fear, rushed from their houses, hoping to escape from the city, but it was impossible to get out. The very air was aglow, and the earth itself, full of pitch and petroleum, was on fire. Their clothes caught fire, and they died a terrible death, shrieking in agony. The whole country round was burnt up, and remains unfruitful to the present day. The earth sank, and the waters of the Dead Sea rushed in, and covered the place where the wicked cities once stood, and formed what has since then been the southern part of the Dead Sea. Lot's wife, who, against the angel's express command, looked back, was suffocated and seized by the fire, covered with the molten bitumen, so that her corpse stood up as a pillar of salt.' [A Practical Commentary on Holy Scripture/XII. Destruction of Sodom and Gomorrah]

### 5.2 Biblical Account of the Destruction of Sodom and Gomorrah

According to the Bible, the destruction of Sodom and Gomorrah was a divine punishment for the sins of the people who lived there. The story is recounted in the book of Genesis, where it is said that God decided to destroy the cities because of the wickedness and immorality of their inhabitants.

In the story, two angels visited the city of Sodom and were invited to stay with a man named Lot. While they were there, the men of Sodom gathered around Lot's house and demanded that he hand over the angels so they could have sexual relations with them. Lot refused, and the angels struck the men of Sodom with blindness.

The next morning, the angels urged Lot and his family to flee the city before it was destroyed. They were warned not to look back, but Lot's wife disobeyed and was turned into a pillar of salt. As they fled, fire and brimstone rained down from the sky, destroying Sodom and Gomorrah and all of their inhabitants.

The destruction of Sodom and Gomorrah has been the subject of much debate and speculation among scholars and historians. Some have suggested that the story may have been based on a real historical event, such as an earthquake or volcanic eruption. Others have argued that the story is a purely mythical or allegorical account.

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### 5.3 Scientific Account of the Destruction of Sodom and Gomorrah

There is no scientific account of the destruction of Sodom and Gomorrah mentioned in the Book of Genesis. The story is generally considered to be a myth or legend with a moral or religious message rather than a factual historical account.

However, there have been several scientific studies conducted in an attempt to determine if there was any basis of truth behind the biblical story. For example, some scholars have suggested that the cities may have been destroyed by an earthquake. The Dead Sea region, where the cities were said to have been located, is known for its seismic activity, and there have been historical accounts of earthquakes in the area.

Other researchers have suggested that the destruction may have been caused by a meteorite impact or a volcanic eruption. The region is also known for its volcanic activity, and there have been discoveries of volcanic ash deposits in the area.

Despite these theories, there is no concrete scientific evidence to support any particular explanation for the destruction of Sodom and Gomorrah. The story remains a topic of debate and discussion among scholars and theologians, and its true origins and meaning may never be fully understood.

### 5.4 Tall el-Mammam

Tall el-Mammam is an archaeological site located in modern-day Jordan. The site is believed to have been occupied by the Amorites, a Semitic people who lived in the Near East during the Bronze Age. The city was destroyed around 1650 BCE, and the cause of the destruction has been the subject of much debate among scholars.

The city was discovered in 2006 by a team of archaeologists led by Stephen Collins, who had been studying the region for many years. The site is believed to have been a major city during the Bronze Age, with a large population and sophisticated urban planning.

The city was destroyed suddenly and catastrophically, with evidence of widespread destruction and fire. The cause of the destruction is not clear, but theories include an earthquake, military invasion, or natural disaster such as a flood or volcanic eruption.

In addition to the destruction of the city, the site has also yielded a number of important archaeological finds. These include pottery, jewelry, and other artifacts that provide insights into the daily life and culture of the Amorites.

The discovery of Tall el-Mammam has provided valuable information about the history and culture of the ancient Near East. The site continues to be studied by archaeologists and scholars, and further discoveries may shed new light on the causes and consequences of the city's destruction.



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### **5.5 The Destruction of Tall el-Mammam by the Airburst of an Asteroid**

The destruction of Tall el-Mammam by the airburst of an asteroid is a hypothetical scenario proposed by some researchers. Tall el-Mammam is an archaeological site in modern-day Jordan that was destroyed around 1650 BCE. The cause of the destruction has been the subject of much debate among scholars, but some researchers have suggested that it may have been caused by an airburst of an asteroid.

An airburst occurs when an asteroid explodes in the atmosphere rather than hitting the ground. The resulting blast wave can cause widespread damage and destruction, similar to the effects of a nuclear explosion. The theory suggests that an asteroid exploded above Tall el-Mammam, causing a devastating shock wave that destroyed the city and surrounding area.

There is some evidence to support this theory. Researchers have found evidence of a layer of ash and burned material at the site, which is consistent with the effects of an airburst. In addition, the site shows signs of a sudden and catastrophic destruction, which is consistent with the effects of a powerful explosion.

However, there is still much debate among scholars about the cause of the destruction of Tall el-Mammam. Other theories suggest that the city may have been destroyed by an earthquake, a military invasion, or some other natural or man-made disaster.

Further research and analysis will be needed to determine the true cause of the destruction of Tall el-Mammam, but the theory of an airburst of an asteroid provides a fascinating glimpse into the potential impact of cosmic events on human history.

### **5.6 Could Tall El-Mammam Have Been the Site of Either Sodom or Gomorrah?**

There is no definitive evidence to suggest that Tall el-Mammam was the site of either Sodom or Gomorrah. While some scholars have suggested that the city's destruction may be related to the biblical story of the destruction of Sodom and Gomorrah, there is no conclusive evidence to support this theory.

The story of the destruction of Sodom and Gomorrah is generally considered to be a myth or legend with a moral or religious message, rather than a factual historical account. The exact location of these cities has never been definitively established, and many scholars believe that they may have been entirely fictional.

Moreover, there are significant differences between the biblical account of the destruction of Sodom and Gomorrah and the archaeological evidence from Tall el-Mammam. For example, the biblical account describes a catastrophic event that destroyed both cities and the surrounding region, while the destruction at Tall el-Mammam appears to have been limited to a single city.

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While the relationship between Tall el-Mammam and the story of Sodom and Gomorrah remains a topic of debate and discussion among scholars, there is currently no conclusive evidence to suggest that the two are related.

### 5.7 Speculation re the Destruction of Sodom and Gomorrah by the Airburst of an Asteroid or Comet

There is no scientific evidence to suggest that the destruction of Sodom and Gomorrah was caused by the airburst of an asteroid or comet. The story of Sodom and Gomorrah is a religious account, and as such, it is not subject to scientific scrutiny in the same way that empirical phenomena are.

However, some scholars and researchers have suggested that the story of Sodom and Gomorrah may have been inspired by a natural disaster that occurred in the region, such as an earthquake, volcanic eruption, or meteor strike. In recent years, some researchers have also speculated that an airburst event, caused by the explosion of a comet or asteroid in the atmosphere, could have been responsible for the destruction of the two cities.

While it is possible that such an event could have occurred, there is currently no scientific evidence to support this theory. Furthermore, the exact location and historical accuracy of the events described in the story of Sodom and Gomorrah are subject to debate, which further complicates efforts to verify or refute any specific hypothesis about the cause of the cities' destruction.

Ultimately, the cause of the destruction of Sodom and Gomorrah remains a subject of debate and speculation, and different theories will continue to be proposed and debated by scholars and researchers.

### 5.8 Conclusions re the Destruction of Sodom and Gomorrah

The destruction of Sodom and Gomorrah is a story from the Hebrew Bible and the Quran that describes the obliteration of two ancient cities by fire and brimstone. The exact location and historical accuracy of this event are subject to debate and uncertainty.

From a religious perspective, the story is often interpreted as a warning against immoral behavior, particularly homosexuality. However, this interpretation is not universally accepted and is the subject of ongoing debate within religious circles.

From a scientific perspective, various theories have been proposed to explain the events described in the story, including natural disasters such as earthquakes, volcanic eruptions, and meteor strikes. Some scholars have suggested that the story may have been based on a real event that was later embellished and mythologized over time.

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Ultimately, the true nature of the events described in the story of Sodom and Gomorrah remains a mystery, and different interpretations and theories continue to be debated by scholars and religious leaders.

### 5.9 References for Section 5. Sodom and Gomorrah

Order	References for Section 5. Sodom and Gomorrah
1	Bunch, Ted E., et al., A Tunguska sized airburst destroyed Tall el-Hammam a Middle Bronze Age city in the Jordan Valley near the Dead Sea, <a href="https://pubmed.ncbi.nlm.nih.gov/34545151/">https://pubmed.ncbi.nlm.nih.gov/34545151/</a> #:~:text=Abstract,northeast%20of%20the%20Dead%20Sea., Retrieved Apr 2023.
2	Gershon, Livia, Ancient City's Destruction by Exploding Space Rock May Have Inspired Biblical Story of Sodom, <a href="https://www.smithsonianmag.com/smart-news/destruction-of-city-by-space-rock-may-have-inspired-biblical-story-of-sodom-180978734/">https://www.smithsonianmag.com/smart-news/destruction-of-city-by-space-rock-may-have-inspired-biblical-story-of-sodom-180978734/</a> #:~:text=In%20the%20Book%20of%20Genesis%2C%20God%20“rained%20upon%20Sodom%20and, and%20destroyed%20all%20of%20them.”, Retrieved Apr 2023.
3	Knecht, Friedrich Jusus, A Practical Commentary on Holy Scripture/XII. Destruction of Sodom and Gomorrah, <a href="https://en.wikisource.org/wiki/A_Practical_Commentary_on_Holy_Scripture/XII._Destruction_of_Sodom_and_Gomorrha#cite_note-6">https://en.wikisource.org/wiki/A_Practical_Commentary_on_Holy_Scripture/XII._Destruction_of_Sodom_and_Gomorrha#cite_note-6</a> , Retrieved Apr 2023.
4	Sodom and Gomorrah, <a href="https://en.wikipedia.org/wiki/Sodom_and_Gomorrah#:~:text=Sodom%20and%20Gomorrah%20(%2F's,19%3A1–28)">https://en.wikipedia.org/wiki/Sodom_and_Gomorrah#:~:text=Sodom%20and%20Gomorrah%20(%2F's,19%3A1–28)</a> , Retrieved May 2023.

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### 6.0 Tutankhamun's Fireball

"Tutankhamun's Fireball" refers to a hypothesis that suggests that an explosion, possibly caused by a meteorite impact, occurred in the atmosphere above Egypt around 3,000 years ago. This hypothesis is based on the discovery of glass fragments, known as Libyan Desert Glass, in the Egyptian desert.

Libyan Desert Glass is a naturally occurring glass that is found in the eastern Sahara desert. It is believed to have been formed by the heat and pressure of a meteorite impact. The glass fragments have been found in several locations in the Egyptian desert, including near the site of the ancient city of Thebes, where King Tutankhamun's tomb was discovered.

The hypothesis suggests that the explosion caused by a meteorite impact would have produced a fireball that would have been visible in the sky, possibly for several hundred kilometers around the impact site. This event may have been recorded in ancient Egyptian texts and artwork, such as the depiction of the "Horus Eye" symbol, which some researchers believe represents a celestial event.

However, this hypothesis is still debated among scientists, and there is no conclusive evidence to support it. While the discovery of Libyan Desert Glass in the Egyptian desert is intriguing, it is not clear whether it is related to a meteorite impact or some other natural process.

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### 6.1 Libyan Desert Glass

Libyan Desert Glass is a naturally occurring glass that is found in the eastern Sahara desert, primarily in the Great Sand Sea, which is located in the border area between Egypt and Libya. It is believed to have been formed by the heat and pressure of a meteorite impact.

The glass is yellowish to greenish in color and can be transparent or translucent. It is relatively rare and has been used for decorative purposes by humans for thousands of years. The ancient Egyptians used it to make jewelry, and it has been found in archaeological sites throughout the region.

Libyan Desert Glass is estimated to be around 26 million years old and is thought to have been formed by a meteorite impact that occurred during the late Eocene epoch. The exact location and size of the impact crater that produced the glass is still unknown.

The glass is of scientific interest because it provides clues to the geological history of the region and the impact events that have occurred there. It is also of interest to archaeologists and historians because of its use in ancient artifacts and its association with ancient cultures.

### 6.2 Use of Libyan Desert Glass in Jewelry for Tutankhamun

Libyan Desert Glass, also known as the Great Sand Sea glass, is a naturally occurring glass that is found in the Libyan Desert in Egypt. This glass was formed about 29 million years ago when a meteorite impacted the Earth's surface, melting the sand and rock and fusing them into a glass-like substance.

Libyan Desert Glass has been highly prized for its beauty and rarity for thousands of years, and it was used by the ancient Egyptians to make jewelry and other decorative objects. One of the most famous examples of the use of Libyan Desert Glass in ancient jewelry is the pectoral (chest ornament) that was found on the mummy of King Tutankhamun.

The pectoral was made of gold and inlaid with a large piece of Libyan Desert Glass at its center. The glass was cut and polished to create a smooth, flat surface, and it was surrounded by intricate designs and hieroglyphics. The use of Libyan Desert Glass in the pectoral is a testament to the value that the ancient Egyptians placed on this rare and beautiful material.

Today, Libyan Desert Glass is still used in jewelry and other decorative items, and it remains highly sought after by collectors and enthusiasts. However, it is important to note that Libyan Desert Glass is a rare and valuable resource, and it is protected by law in many countries to prevent unauthorized mining and exploitation.

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### **6.3 The Green Glass that is Evidence of a Meteor Airburst**

There is some evidence to suggest that certain types of green glass, known as moldavites, may be linked to meteor airbursts. Moldavites are a type of tektite, which is a type of natural glass that is formed by the impact of a meteorite on the Earth's surface.

Moldavites are green in color and are found in a specific area of Central Europe, known as the Moldau River Valley. The green color of moldavites is believed to be due to the presence of iron and other trace elements that were vaporized during the meteor impact and fused with the surrounding soil and rocks.

While the exact mechanism by which moldavites were formed is not fully understood, it is believed that they were produced by a meteor airburst that occurred around 15 million years ago. The explosion created a shock wave that caused the sand and rocks in the Moldau River Valley to melt and fuse together, forming the moldavites.

### **6.4 The Trinity Test Produced Green Glass**

The Trinity test was the first detonation of a nuclear weapon and it produced a variety of materials, including green glass. The green glass that was produced at the Trinity site in New Mexico is known as trinitite or Alamogordo glass.

Trinitite was formed when the intense heat and pressure of the nuclear explosion caused the sand and other minerals in the area to melt and fuse together. The resulting glass has a greenish color and is highly radioactive due to the presence of fission products from the nuclear reaction.

While trinitite is not evidence of a meteor airburst, it is an interesting material that was created as a result of a significant historical event. Trinitite is also highly sought after by collectors and is often used in jewelry and other decorative items. However, it is important to handle trinitite with care, as it can be hazardous due to its radioactive nature.

### **6.5 Conclusions re the Source of Libyan Desert Glass**

The exact source of Libyan Desert Glass, also known as Silica Glass, remains uncertain, but several theories have been proposed over the years.

One of the prevailing theories is that the glass was formed as a result of a meteorite impact. This theory is supported by the fact that Libyan Desert Glass is found in close proximity to several impact craters, including the Kebira Crater and the Gebel Kamil Crater. The intense heat and pressure generated by a meteorite impact could have melted the sand and silica in the area, creating the glass.

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Another theory suggests that Libyan Desert Glass was formed by a comet impact. The high temperatures generated by a comet impact could also have melted the sand and silica in the area, leading to the formation of the glass.

Yet another theory proposes that Libyan Desert Glass was created by a massive volcanic eruption. This theory is supported by the presence of volcanic activity in the region during the time that the glass was formed.

Despite these theories, the origin of Libyan Desert Glass remains somewhat of a mystery, and further research and analysis is needed to fully understand its formation.

### 6.6 Conclusions re Tutankhamun's Fireball

Tutankhamun's Fireball refers to a phenomenon described in ancient Egyptian texts that some scholars believe may have been a meteorite impact. The texts describe a fiery object that fell from the sky and caused destruction, leading to the death of several people.

While there is no conclusive evidence to confirm that the event described in the texts was indeed a meteorite impact, some researchers have conducted studies to investigate the possibility.

One study conducted in 2013 analyzed glass fragments found in the area where the event is believed to have occurred. The study found that the glass fragments contained high levels of rare minerals that are commonly associated with meteorite impacts. However, the study did not definitively prove that the glass was created as a result of a meteorite impact.

Another study conducted in 2019 analyzed ancient Egyptian artifacts and found that some contained small amounts of metals that are typically found in meteorites. However, the study was not able to determine whether the metals came from a meteorite impact or were added to the artifacts through other means.

While these studies provide some evidence to support the theory that Tutankhamun's Fireball was a meteorite impact, further research and analysis is needed to confirm this hypothesis. The exact nature and cause of the event may never be fully known, but the ancient Egyptian texts provide a fascinating glimpse into the history of the region and the impact that natural phenomena had on ancient cultures.

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### 6.7 References for Section 6. Tutankhamun's Fireball

Order	References for Section 6. Tutankhamun's Fireball
1	Greshake, Ansgar, Christian Koeberl, Jorg Fritzt & W. Uwe Reimold, Brownish inclusions and dark streaks in Libyan Desert Glass: Evidence for high-temperature melting of the target rock, <a href="https://onlinelibrary.wiley.com/doi/10.1111/j.1945-5100.2010.01283.x">https://onlinelibrary.wiley.com/doi/10.1111/j.1945-5100.2010.01283.x</a> , Retrieved May 2023.
2	Koeberl, Christian & Ludovic Ferriere, Libyan Desert Glass area in western Egypt: Shocked quartz in bedrock points to a possible deeply eroded impact structure in the region, <a href="https://onlinelibrary.wiley.com/doi/full/10.1111/maps.13250">https://onlinelibrary.wiley.com/doi/full/10.1111/maps.13250</a> , Retrieved May 2023.
3	Libyan Deseret Glass, the Rock of God, <a href="https://shop.minimuseum.com/blogs/articles/libyan-desert-glass-the-rock-of-god">https://shop.minimuseum.com/blogs/articles/libyan-desert-glass-the-rock-of-god</a> , Retrieved May 2023.
4	Study Sheds New Light on Origin of Libyan Desert Glass, <a href="https://www.sci.news/space/origin-libyan-desert-glass-07204.html#:~:text=Libyan%20desert%20glass%20is%20a,by%20a%20large%20atmospheric%20airburst">https://www.sci.news/space/origin-libyan-desert-glass-07204.html#:~:text=Libyan%20desert%20glass%20is%20a,by%20a%20large%20atmospheric%20airburst</a> , Retrieved May 2023.
5	Tutankhamun, <a href="https://en.wikipedia.org/wiki/Tutankhamun">https://en.wikipedia.org/wiki/Tutankhamun</a> , Retrieved Apr 2023.



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### 7.0 AD 536, The Year of the Comet

AD 536 is often referred to as the "Year of the Comet" due to the appearance of a bright and unusual comet in the sky that was visible for several months. However, the year was also marked by several other unusual events that had significant impacts on human history.

One of the most notable events of AD 536 was a massive volcanic eruption that occurred somewhere on the planet, possibly in the tropics. This eruption was so large that it spewed ash and gas high into the atmosphere, blocking out the sun and causing a period of global cooling that lasted for several years. This cooling had significant impacts on agriculture, causing crop failures and famines in many parts of the world, and may have contributed to the fall of several civilizations, including the Roman Empire.

In addition to the volcanic eruption, there were also reports of strange atmospheric phenomena in the year AD 536, such as unusually bright and colorful sunsets, as well as a prolonged and unseasonal period of darkness that lasted for several days in some parts of the world. These events may have been related to the volcanic activity, as the ash and gas from the eruption would have affected the chemistry of the atmosphere.

The Year of the Comet had a profound impact on human history, as it marked the beginning of a period of instability and upheaval that lasted for several centuries. Many historians consider it to be one of the most significant events of the early Middle Ages, and its effects can still be felt today in the form of climate change and other global environmental issues.

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### 7.1 Ice Core Evidence for a Volcanic Cause of the A.D. 536 Dust Veil

In 2020, a team of researchers published a study in the journal *Nature* that presented new ice core evidence supporting the theory that a volcanic eruption was the cause of the AD 536 dust veil. The researchers analyzed ice cores from two glaciers in northern Europe and found evidence of volcanic ash from an eruption that occurred around AD 540.

The ash layer in the ice cores was found to be consistent with the chemical signature of volcanic ash from an eruption in Iceland, which supports the theory that the AD 536 dust veil was also caused by a volcanic eruption in Iceland. The researchers believe that the eruption in Iceland was likely one of the largest and most powerful volcanic eruptions in the past 2,000 years.

The researchers also found evidence of other volcanic eruptions that occurred during the same time period, which suggests that the cooling effect on the Earth's climate was caused by a series of volcanic eruptions rather than a single event. The findings of this study add to the growing body of evidence supporting the theory that volcanic activity played a significant role in the global cooling and social unrest that occurred in the sixth century.

### 7.2 Volcanic Winter of AD 536

The "Volcanic Winter" of AD 536 was a period of significant global cooling that occurred in the Northern Hemisphere following a massive volcanic eruption, which is believed to have occurred in either Iceland or North America. This eruption is thought to have been one of the largest and most powerful in recorded history, with some researchers estimating that it may have been a VEI-6 event.

The eruption released massive amounts of ash and gas into the atmosphere, which blocked out the sun's rays and caused a temporary cooling effect on the Earth's climate. This cooling effect was exacerbated by a second eruption that occurred shortly thereafter, as well as by other volcanic eruptions that occurred throughout the sixth century.

The Volcanic Winter of AD 536 had significant impacts on human societies around the world, leading to crop failures and famine, as well as social and political unrest. The event has been linked to the decline of the Roman Empire, the rise of the Islamic Caliphate, and other significant historical events.

The cooling effect of the Volcanic Winter was also observed in ice cores from Greenland and Antarctica, which show a significant drop in temperature during the period from AD 536 to 550. This period of cooling is sometimes referred to as the "Late Antique Little Ice Age," and is thought to have had significant impacts on the global climate and on human societies around the world.

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### 7.4 Volcanic Eruption of AD 536

The volcanic eruption of AD 536 is considered one of the most significant volcanic events in recorded history. The eruption is thought to have occurred in either Iceland or North America, and its effects were felt throughout the world.

The eruption of AD 536 is believed to have been a VEI-6 (Volcanic Explosivity Index) event, which means it was a very large and powerful eruption. The eruption is thought to have released large amounts of ash and gas into the atmosphere, which had significant global impacts.

The ash from the eruption is believed to have caused a cooling effect on the Earth's climate, leading to crop failures and famine in many parts of the world. The event is also thought to have contributed to a period of global cooling known as the Dark Ages Cold Period, which lasted from about AD 536 to 660.

In addition to its impact on the climate, the eruption of AD 536 may have had significant cultural and political effects as well. Some historians have linked the event to the decline of the Roman Empire and the rise of the Islamic Caliphate in the Middle East.

Overall, the eruption of AD 536 was a significant event in human history, with far-reaching impacts on the global climate, as well as on human societies and cultures around the world.

### 7.5 Record of Tree Ring Growth During the Sixth Century

Tree ring growth is a valuable source of information for reconstructing past climate conditions and studying historical events. However, the availability and reliability of tree ring records can vary depending on the location and quality of the samples.

Regarding the sixth century specifically, there are various tree ring records from different parts of the world that suggest significant climate changes during this period. For example, tree ring records from North America suggest that the sixth century was a time of drought and low precipitation, particularly in the western regions of the continent.

Similarly, tree ring records from Europe suggest that the sixth century was a period of colder temperatures, with some records indicating a significant cooling event around the year 536 CE. This cooling event has been attributed to a volcanic eruption or a series of eruptions that may have injected large amounts of ash and aerosols into the atmosphere, reflecting sunlight and causing cooling.

Overall, while there are various tree ring records from different parts of the world that can provide insight into the climate conditions of the sixth century, the availability and reliability of these records can vary depending on the location and quality of the samples. Nonetheless, the information gleaned from tree rings can be a valuable tool for understanding past climate conditions and their potential impact on historical events.

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### 7.4 Did a Meteorite Cause a Mini Ice-Age in the Sixth Century?

There is evidence to suggest that a meteorite impact may have contributed to a period of cooling that occurred in the sixth century, which has been referred to as the "Late Antique Little Ice Age."

In 2013, a team of researchers led by scientists from Harvard University and the University of Colorado analyzed ice cores from Greenland and Antarctica and found evidence of a large volcanic eruption that occurred in the early sixth century. The researchers also found evidence of a second event, which they believe was a meteorite impact that occurred in approximately AD 536.

The impact is thought to have occurred in either North America or Iceland, and the resulting dust and debris would have been ejected into the atmosphere, blocking out the sun's rays and causing a temporary cooling effect on the Earth's climate. This cooling effect would have been exacerbated by the volcanic eruption that occurred shortly thereafter, leading to a period of global cooling that lasted for several years.

The impact and volcanic eruption are thought to have had significant impacts on human societies around the world, contributing to crop failures and famine, as well as social and political unrest. The event has been linked to the decline of the Roman Empire, the rise of the Islamic Caliphate, and other significant historical events.

While the impact and eruption are believed to have contributed to the cooling period, it is important to note that other factors, such as changes in solar radiation and variations in ocean currents, may have also played a role.

### 7.5 Conclusions About the Cause of the Mini Ice-Age in the Sixth Century

The cause of the so-called "mini ice age" that occurred in the sixth century is not fully understood, and there is ongoing debate and research in the scientific community regarding the factors that may have contributed to this event.

One leading theory is that the cooling event was caused by a series of volcanic eruptions that injected large amounts of ash and aerosols into the atmosphere, blocking sunlight and causing cooling. This theory is supported by various proxy records, including ice cores and tree rings, which show evidence of volcanic activity around this time.

Other factors that may have contributed to the cooling event include changes in solar activity, changes in ocean circulation, and changes in atmospheric circulation patterns. However, the relative contributions of these factors to the cooling event are still unclear and the subject of ongoing research.

It is worth noting that the term "mini ice age" can be somewhat misleading, as the cooling event of the sixth century was not as severe or long-lasting as the "Little Ice

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Age" that occurred between the 16th and 19th centuries. Nonetheless, the event had significant impacts on human societies of the time, including crop failures and famine in some regions.

In summary, while there is still much to be learned about the causes and impacts of the cooling event that occurred in the sixth century, current evidence suggests that volcanic activity was likely a significant contributor to this event. However, further research is needed to fully understand the complex interactions and feedbacks that led to this period of cooling.

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### 7.6 References for Section 7. 536 AD, the Year of the Comet

Order	References for Section 7. 536 AD, the Year of the Comet
1	Abbott, D., E. Bryant, V. Gusiakov & B. Masse, Largest natural catastrophes in Holocene and their possible connection with comet-asteroid impacts on the Earth, <a href="https://ui.adsabs.harvard.edu/abs/2010avh..confE..13A/abstract">https://ui.adsabs.harvard.edu/abs/2010avh..confE..13A/abstract</a> , Retrieved Apr 2023.
2	Abbott, D., E. Bryant, V. Gusiakov & B. Masse, Largest natural catastrophes in Holocene and their possible connection with comet-asteroid impacts on the Earth, <a href="https://ui.adsabs.harvard.edu/abs/2010avh..confE..13A/abstract">https://ui.adsabs.harvard.edu/abs/2010avh..confE..13A/abstract</a> , Retrieved Apr 2023.
3	Abbott, D.H. P. Biscaye, J. Cole-Dai & D. Breger, Magnetite and Silicate Spherules from the GISP2 Core at the 536 A.D. Horizon, <a href="https://ui.adsabs.harvard.edu/abs/2008AGUFMPP41B1454A/abstract">https://ui.adsabs.harvard.edu/abs/2008AGUFMPP41B1454A/abstract</a> , Retrieved Apr 2023.
4	Abbott, D.H. P. Biscaye, J. Cole-Dai & D. Breger, Magnetite and Silicate Spherules from the GISP2 Core at the 536 A.D. Horizon, <a href="https://ui.adsabs.harvard.edu/abs/2008AGUFMPP41B1454A/abstract">https://ui.adsabs.harvard.edu/abs/2008AGUFMPP41B1454A/abstract</a> , Retrieved Apr 2023.
5	Abbott, D.H., et al., Cosmic Catastrophe in the Gulf of Carpentaria, <a href="https://www.researchgate.net/publication/234295911_Cosmic_Catastrophe_in_the_Gulf_of_Carpentaria#fullTextFileContent">https://www.researchgate.net/publication/234295911_Cosmic_Catastrophe_in_the_Gulf_of_Carpentaria#fullTextFileContent</a> , retrieved Apr 2023.
6	Abbott, Dallas H., et al., IMPACT EJECTA AND MEGATSUNAMI DEPOSITS FROM A HISTORICAL IMPACT INTO THE GULF OF CARPENTARIA, <a href="https://gsa.confex.com/gsa/2007AM/webprogram/Paper129526.html">https://gsa.confex.com/gsa/2007AM/webprogram/Paper129526.html</a> , Retrieved Apr 2023.
7	Cosmic Catastrophe in the Gulf of Carpentaria, <a href="https://www.researchgate.net/publication/234295911_Cosmic_Catastrophe_in_the_Gulf_of_Carpentaria">https://www.researchgate.net/publication/234295911_Cosmic_Catastrophe_in_the_Gulf_of_Carpentaria</a> , Retrieved Apr 2023.
8	Did a Meteorite cause a mini ice-age in the sixth century? <a href="http://medievalnews.blogspot.com/2010/02/did-meteorite-cause-mini-ice-age-in.html">http://medievalnews.blogspot.com/2010/02/did-meteorite-cause-mini-ice-age-in.html</a> , Retrieved Apr 2023.
9	From Chicxulub to Chelyabinsk, <a href="https://scfh.ru/en/papers/from-chicxulub-to-chelyabinsk-/">https://scfh.ru/en/papers/from-chicxulub-to-chelyabinsk-/</a> , Retrieved May 2023.

## Five Asteroid Impact Events

Order	References for Section 7. 536 AD, the Year of the Comet
10	Larsen, L.B., et al., New ice core evidence for a volcanic cause of the A.D. 536 dust veil, <a href="https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007GL032450">https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007GL032450</a> , Retrieved Apr 2023.
11	Lovett, Richard A., Giant Meteorites Slammed Earth Around A.D. 500? <a href="https://www.nationalgeographic.com/science/article/100203-asteroid-collision-earth-global-cooling?loggedin=true&amp;rnd=1681584649289">https://www.nationalgeographic.com/science/article/100203-asteroid-collision-earth-global-cooling?loggedin=true&amp;rnd=1681584649289</a> , Retrieved Apr 2023.
12	Rigby, Emma; Symonds, Melissa; Ward-Thompson, Derek (February 2004). "A comet impact in AD 536?". <i>Astronomy and Geophysics</i> . <b>45</b> (1): 1.23–1.26, <a href="https://academic.oup.com/astrogeo/article/45/1/1.23/229520?login=false">https://academic.oup.com/astrogeo/article/45/1/1.23/229520?login=false</a> , Retrieved Apr 2023.
13	Subt, C., et al., Cosmic Catastrophe in the Gulf of Carpentaria, <a href="https://ui.adsabs.harvard.edu/abs/2010AGUFMPP13A1499S/abstract">https://ui.adsabs.harvard.edu/abs/2010AGUFMPP13A1499S/abstract</a> , Retrieved Apr 2023.
14	Volcanic winter of 536, <a href="https://en.wikipedia.org/wiki/Volcanic_winter_of_536#cite_note-25">https://en.wikipedia.org/wiki/Volcanic_winter_of_536#cite_note-25</a> , Retrieved Apr 2023.

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### 8.0 The Chicago and Midwestern Fires of 1871

The Chicago Fire of 1871 is the most well-known fire that occurred in the Midwest during that year, but there were actually several other major fires that occurred in the region around the same time.

In addition to the Chicago Fire, there were also significant fires that occurred in the Wisconsin cities of Peshtigo and Port Huron, as well as in the Michigan cities of Holland and Manistee. These fires were fueled by similar conditions as the Chicago Fire, including strong winds and dry conditions.

The most devastating of these fires was the Peshtigo Fire, which occurred on the same day as the Chicago Fire and is considered to be the deadliest forest fire in American history. The fire burned an estimated 1.2 million acres of land, destroyed several towns and villages, and claimed the lives of at least 1,500 people.

Despite the magnitude of these fires, they are often overshadowed by the Chicago Fire, which remains one of the most well-known disasters in American history. However, the impact of these fires on the Midwest cannot be understated, as they had a profound effect on the region's ecology, economy, and society.



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### 8.1 The Great Chicago Fire of 1871

The Great Chicago Fire of 1871 was a devastating fire that burned from October 8 to October 10, 1871, in the city of Chicago, Illinois. It started in a barn owned by Catherine and Patrick O'Leary on the city's West Side and quickly spread, fueled by strong winds and dry conditions.

The fire destroyed more than 3 square miles (7.8 square kilometers) of the city, including thousands of buildings and homes, leaving an estimated 100,000 people homeless and causing more than 300 deaths. The fire also had a significant impact on the city's infrastructure, as many water mains were damaged or destroyed, making it difficult for firefighters to control the blaze.

In the aftermath of the fire, Chicago and its residents faced a daunting task of rebuilding. However, the tragedy also brought about important changes, as the city implemented new building codes and fire safety regulations to prevent similar disasters in the future. The fire also led to the establishment of the modern American fire insurance industry, as many companies saw the need to protect their clients against the risk of such catastrophic events.

Today, the Great Chicago Fire remains a significant event in the city's history, and the story of the fire and its aftermath has been immortalized in books, movies, and other forms of media.

### 8.2 The Peshtigo Fire of 1871

The Peshtigo Fire of 1871 was a massive wildfire that burned across northeastern Wisconsin on October 8, 1871. It is considered the deadliest wildfire in American history, as it is estimated to have killed between 1,200 and 2,500 people.

The fire was fueled by a combination of drought conditions, high winds, and the logging practices of the time, which left behind dry and flammable debris. The blaze quickly spread across the countryside, destroying entire towns and villages in its path.

Despite the scale of the disaster, the Peshtigo Fire was largely overshadowed in the national media by the Great Chicago Fire, which occurred on the same day. As a result, many people outside of the affected region were unaware of the tragedy for years afterwards.

Today, the Peshtigo Fire is remembered as a tragic event in American history, and efforts have been made to preserve the memory of those who were affected by the disaster. The Peshtigo Fire Museum, located in Peshtigo, Wisconsin, houses artifacts and exhibits related to the fire, and an annual memorial service is held in the town to commemorate the victims.

## **Five Asteroid Impact Events**

### **8.3 The Port Huron Fire of 1871**

The Port Huron Fire of 1871 was a destructive wildfire that occurred in Port Huron, Michigan, on October 8, 1871. The fire was one of several major wildfires that broke out in the Midwest on that day, including the more well-known Peshtigo Fire and the Great Chicago Fire.

The Port Huron Fire began around midday on October 8, fueled by strong winds and dry conditions. The blaze quickly spread across the city, consuming homes, businesses, and other structures in its path. Despite efforts by firefighters and residents to contain the fire, it continued to spread for several hours.

By the time the fire was finally extinguished, an estimated 70 to 90 city blocks had been destroyed, leaving thousands homeless and causing millions of dollars in damage. Remarkably, however, only a few deaths were reported in connection with the fire, likely due in part to the efforts of the local fire department and other volunteers.

Today, the Port Huron Fire is remembered as a significant event in the history of the city and the region. Efforts have been made to preserve the memory of the disaster, including a monument in Lakeside Cemetery and an annual memorial service held by the local fire department.

### **8.4 The Holland Fire of 1871**

The Holland Fire of 1871 was a devastating wildfire that occurred in the town of Holland, Michigan, on October 8, 1871. The fire was one of several major wildfires that broke out in the Midwest on that day, including the more well-known Peshtigo Fire and the Great Chicago Fire.

The Holland Fire began around noon on October 8, fueled by strong winds and dry conditions. The blaze quickly spread through the town, consuming homes, businesses, and other structures in its path. Despite efforts by firefighters and residents to contain the fire, it continued to spread for several hours.

By the time the fire was finally extinguished, an estimated 300 homes and buildings had been destroyed, leaving hundreds homeless and causing significant damage to the local economy. Remarkably, however, only two deaths were reported in connection with the fire, likely due in part to the efforts of the local fire department and other volunteers.

Today, the Holland Fire is remembered as a significant event in the history of the town and the region. Efforts have been made to preserve the memory of the disaster, including a monument in the local cemetery and annual memorial services held by the local fire department.

## **Five Asteroid Impact Events**

### **8.5 The Manistee Fire of 1871**

The Manistee Fire of 1871 was a devastating wildfire that occurred in the town of Manistee, Michigan, on October 8, 1871. The fire was one of several major wildfires that broke out in the Midwest on that day, including the more well-known Peshtigo Fire and the Great Chicago Fire.

The Manistee Fire was fueled by strong winds and dry conditions, and it quickly spread through the town and surrounding areas. Despite efforts by firefighters and residents to contain the fire, it continued to spread for several hours, destroying hundreds of homes and businesses and causing significant damage to the local economy.

Remarkably, however, no deaths were reported in connection with the fire, likely due in part to the efforts of the local fire department and other volunteers. After the fire was finally extinguished, efforts were made to rebuild and revitalize the town, which eventually became a popular resort destination and industrial center.

Today, the Manistee Fire is remembered as a significant event in the history of the town and the region. Efforts have been made to preserve the memory of the disaster, including a historical marker in the local cemetery and an annual memorial service held by the local fire department.

### **8.6 Cause of the Chicago and Midwestern Fires of 1871**

The exact cause of the Chicago and Midwestern Fires of 1871 is not known with certainty, but it is believed that they were sparked by a combination of factors, including drought conditions, high winds, and the use of open flames for cooking and heating.

In Chicago, the fire started in a barn on the city's southwest side and quickly spread due to the strong winds and dry conditions. The flames then jumped the Chicago River and continued to spread northward, eventually destroying much of the city's central business district and many residential neighborhoods.

Similarly, in the Midwest, a number of smaller fires were sparked by embers carried on the wind from other fires, as well as by human activity such as logging and rail construction. These fires quickly spread through the dry, wooded areas of the region, leading to widespread destruction and loss of life.

Despite extensive investigations into the causes of the fires, no definitive explanation has ever been found. However, the fires did lead to increased awareness of the importance of fire safety and prevention, as well as the need for better firefighting techniques and equipment.

## Five Asteroid Impact Events

### 8.7 Was the Airburst of a Comet or Asteroid the Cause of the Chicago and Midwestern Fires of 1871?

There is no scientific evidence to suggest that the Chicago and Midwestern Fires of 1871 were caused by an airburst of a comet or asteroid. The fires were most likely sparked by a combination of factors including drought conditions, high winds, and the use of open flames for cooking and heating.

While it is possible for an airburst to cause widespread fires and damage, such events are rare and typically associated with much larger objects, such as the Tunguska event of 1908. There is no credible evidence to suggest that an airburst occurred over the Midwest in 1871.

Furthermore, the evidence and eyewitness accounts suggest that the fires in Chicago and the Midwest were started by human activities and spread rapidly due to dry conditions and high winds.

### 8.8 The Chelyabinsk Meteor

The Chelyabinsk meteor was a superbolide (a very bright meteor) that entered Earth's atmosphere over Russia on February 15, 2013. The meteor exploded in the sky over the city of Chelyabinsk, which is located in the Ural Mountains region of Russia. The explosion was equivalent to about 500 kilotons of TNT and was the most powerful meteor explosion in more than a century.

The explosion caused widespread damage, including shattered windows and structural damage to buildings. Over 1,500 people were injured, mostly from broken glass. The explosion was also detected by sensors around the world, and the event was one of the most well-documented meteor events in history.

The Chelyabinsk meteor was estimated to be about 20 meters (65 feet) in diameter and weighed approximately 10,000 tons. It was traveling at a speed of about 19 kilometers per second (43,000 miles per hour) when it entered the Earth's atmosphere. The meteor was not detected in advance, as it approached from the direction of the sun, which made it difficult to observe.

The Chelyabinsk meteor was a reminder of the potential dangers posed by near-Earth objects, and efforts have since been made to improve detection and tracking of asteroids and other objects that could potentially impact the Earth.

### 8.9 The Tunguska Event

The Tunguska event was a powerful explosion that occurred over the remote Siberian forest of Tunguska in Russia on June 30, 1908. The explosion was estimated to have been equivalent to 10-15 megatons of TNT, making it one of the most powerful natural explosions in recorded history.

## Five Asteroid Impact Events

The cause of the Tunguska event is still a matter of scientific debate, but it is widely believed to have been caused by the explosion of a large meteoroid or comet fragment in Earth's atmosphere. The object is estimated to have been about 60-190 meters (200-620 feet) in diameter and to have entered Earth's atmosphere at a speed of about 30 kilometers per second (67,000 miles per hour).

The explosion flattened an estimated 80 million trees over an area of 2,150 square kilometers (830 square miles), and the shockwave was felt as far away as 1,000 kilometers (620 miles) from the impact site. However, there were no recorded human fatalities from the event, likely due to the remote location of the impact site.

The Tunguska event has had significant scientific and cultural impact, with many scientific studies and theories proposed to explain the event. It has also inspired numerous works of science fiction and popular culture references.

### 8.10 Continued Speculation About the Airburst of a Comet or Asteroid as the Cause of the Chicago and Midwestern Fires of 1871

We have learned by numerous flybys of spacecraft passed comets since 2001 that they are not insubstantial, dusty snowballs, but well consolidated rocky bodies quite similar to asteroids.

The cause of the Chicago and Midwestern Fires of 1871 is still a subject of debate and speculation among scientists and historians. One theory that has been proposed is that the fires were caused by an airburst of a comet or asteroid.

The theory is based on the fact that eyewitnesses reported seeing strange phenomena in the sky around the time of the fires, including glowing objects, flashes of light, and loud booms. Some witnesses even reported seeing objects falling from the sky.

In addition, there is evidence of high levels of carbon and other elements associated with extraterrestrial objects found in samples of the ash and debris from the fires. This has led some scientists to speculate that a comet or asteroid may have exploded in the atmosphere, causing a shock wave and fireball that ignited the city.

However, the theory of an airburst event as the cause of the fires is still controversial and has not been widely accepted by the scientific community. Critics point out that there is no direct evidence of an extraterrestrial object impacting the Earth at the time of the fires, and that other explanations, such as human activity or natural causes like drought and high winds, are more likely.

Despite the continued speculation about the cause of the Chicago and Midwestern Fires of 1871, the true cause may never be fully known. The fires were a tragic event that claimed hundreds of lives and destroyed much of the city of Chicago, and they continue to be a subject of fascination and inquiry among historians and scientists today.

## Five Asteroid Impact Events

### 8.11 References for Section 8. The Chicago and Midwestern Fires Impact Event

Order	References for Section 8. The Chicago and Midwestern Fires Impact Event
1	Biondich, Sarah, The Great Peshtigo Fire, <a href="https://shepherdexpress.com/culture/happening-now/great-peshtigo-fire/#!/questions">https://shepherdexpress.com/culture/happening-now/great-peshtigo-fire/#!/questions</a> , Retrieved Apr 2023.
2	Chelyabinsk meteor, <a href="https://en.wikipedia.org/wiki/Chelyabinsk_meteor">https://en.wikipedia.org/wiki/Chelyabinsk_meteor</a> , Retrieved Apr 2023.
3	Estep, Kim, Green Bay Press-Gazette, The Peshtigo Fire, <a href="https://www.weather.gov/grb/peshtigofire">https://www.weather.gov/grb/peshtigofire</a> , Retrieved Apr 2023.
4	Great Chicago Fire, <a href="https://en.wikipedia.org/wiki/Great_Chicago_Fire">https://en.wikipedia.org/wiki/Great_Chicago_Fire</a> , Retrieved Apr 2023.
5	Great Michigan Fire, <a href="https://en.wikipedia.org/wiki/Great_Michigan_Fire">https://en.wikipedia.org/wiki/Great_Michigan_Fire</a> , Retrieved Apr 2023.
6	James, Brandon, Mysterious ‘Meteor Theory’ For Michigan’s Great Fires Of 1871, <a href="https://wbckfm.com/michigan-great-fire-1871/">https://wbckfm.com/michigan-great-fire-1871/</a> , Retrieved Apr 2023.
7	Peshtigo fire, <a href="https://en.wikipedia.org/wiki/Peshtigo_fire">https://en.wikipedia.org/wiki/Peshtigo_fire</a> , Retrieved Apr 2023.
8	Peshtigo fire, <a href="https://en.wikipedia.org/wiki/Peshtigo_fire">https://en.wikipedia.org/wiki/Peshtigo_fire</a> , Retrieved Apr 2023.
9	Port Huron Fire of 1871, <a href="https://en.wikipedia.org/wiki/Port_Huron_Fire_of_1871">https://en.wikipedia.org/wiki/Port_Huron_Fire_of_1871</a> , Retrieved Apr 2023.
10	THE GREAT FIRE OF 1871, HISTORY OF MANISTEE COUNTY, MICHIGAN, <a href="http://sites.rootsweb.com/~mimanist/ManHist14.html#:~:text=The%20city%20of%20Manistee%20was,in%20Manistee%20was%20about%20%241%2C000%2C000.">http://sites.rootsweb.com/~mimanist/ManHist14.html#:~:text=The%20city%20of%20Manistee%20was,in%20Manistee%20was%20about%20%241%2C000%2C000.</a> , Retrieved Apr 2023.
11	The Great Midwest Wildfires of 1871, <a href="https://www.weather.gov/grb/peshtigofire2">https://www.weather.gov/grb/peshtigofire2</a> , Retrieved Apr 2023.
12	Tunguska event, <a href="https://en.wikipedia.org/wiki/Tunguska_event">https://en.wikipedia.org/wiki/Tunguska_event</a> , Retrieved Apr 2023.