Volcanoes That Changed the World

Santorini
Type: Stratovolcano, Latitude: 36.4° N, Longitude: 25.4° E, Elevation: 564 m (1,850 feet)
The name Santorini was given to it by the Latin empire in the thirteenth century and is a reference to Saint Irene. Before then it was called Kallistē (“the most beautiful one”), Strongylē (“the circular one”), or Thera. The island was the site of one of the largest volcanic eruptions of the last several thousand years when it erupted cataclysmically about 3,500 years ago during the mycenaean epoch. The eruption left a large caldera surrounded by volcanic ash deposits hundreds of feet deep, and its effects may have indirectly led to the collapse of the Minoan civilization on the island of Crete, 110 km (70 mi) to the south. One popular theory holds that the Thera eruption is the source of the legend of Atlantis. The devastating volcanic eruption of Thera has become the most famous single event in the Aegean before the fall of Troy. The eruption would likely have caused a significant climate upset for the eastern Mediterranean region. It was one of the biggest volcanic eruptions on Earth in the last few thousand years. The rediscovery of the violent explosion of Thera/Santorini spawned some speculative theories that aimed to connect the eruption with history and myth. The eruption of Santorini has been connected to the Israelite Exodus from Egypt.

Mt Vesuvius
Type: Stratovolcano, Latitude: 40°49′N, Longitude: 14°26′E, Elevation: 1281 m
Mount Vesuvius is the only volcano on the European mainland to have erupted within the last hundred years, although it is not currently erupting. The only other two such volcanoes in Italy (Etna and Stromboli) are located on islands. Mount Vesuvius was regarded by the Greeks and Romans as being sacred to the hero and demigod Hercules/Heracles, and the town of Herculanenum, built at its base, was named after him. The mountain was quiet for hundreds of years before the eruption of 79 and was described by Roman writers as having been covered with gardens and vineyards, except at the top which was craggy. Within a large circle of nearly perpendicular cliffs was a flat space large enough for the encampment of the army of the rebel gladiator Spartacus in 73 BC. This area was doubtless a crater. Many of Pompeii's neighboring communities, most famously Herculanenum, also suffered damage or destruction during the 79 eruption, which is thought to have lasted about 19 hours, in which time the volcano released about 1 cubic mile (4 cubic kilometres) of ash and rock over a wide area to the south and south-east of the crater, with about 3 m (10 ft) of tephra falling on Pompeii. The 79 eruption was preceded by a powerful earthquake seventeen years beforehand on 5 February 62. Small earthquakes started taking place on 20 August, 79 becoming more frequent over the next four days, but the warnings were not recognised (it is worth noting the Romans had no word for volcano, and only a hazy concept of other similar mountains like Mount Etna, home of Vulcan), and on the afternoon of 24 August, a catastrophic eruption of the volcano started. The eruption devastated the region, burying Pompeii and other settlements. By coincidence it was the day after Vulcanalia, the festival of the Roman god of fire. It is not known how many people the eruption killed though estimates have the population of Pompeii between 10,000 and 20,000.

Ilopango, El Salvador
Type: Volcanic Caldera, Latitude: 13.672 N, Longitude: 89.053 W, Elevation of Lake: 438 m
Ilopango is a caldera that formed in 260 A.D. Ash from this explosive eruption covered much of central El Salvador. Lake Ilopango fills part of the caldera. Islas Quemadas, a volcanic dome, formed within the caldera in 1879-1880. Periods of dome extrusion coincided with tidal forces. Earthquake swarms preceded each extrusion. A caldera-forming eruption of the Volcano Ilopango devastated the highlands of El Salvador, Central America, covering a broad area under pyroclastic flows and a much larger region under thick layers of tephra. Whereas land lying within a radius of about 60 miles of the vent was rendered completely uninhabitable, areas lying farther away suffered varying degrees of environmental damage, leaving a large population of survivors with no means of subsistence. Besides totally destroying farmlands and villages in the most severely impacted zone around the volcano and disrupting agricultural production over a vast region, the eruption may also have been responsible for a massive redistribution of the Maya population, causing an estimated 320,000 survivors to migrate northward from Salvador to Belize and northern Guatemala. The influx of migrants, displaced by the Ilopango event, may have been a catalyst that helped accelerate the already in-progress development of Classic Maya civilization. Excavations at sites scattered over central and western El Salvador which were affected by the Ilopango cataclysm reveal a wealth of Preclassic Maya artifacts. Located about 40 miles from Ilopango, pre-eruption Chalchuapa was a major residential, economic, and ritual center in the southeast Maya highlands, featuring numerous 50 foot high pyramids arranged around open plazas and elaborately sculptured monuments, some of which bore calendric dates. Numerous ceramic vessels, some with polychrome painting, were found under Ilopango's ubiquitous layer of light-colored ash, known locally as the tierra blanca.

Mt. Merapi, Java (Indonesia)
Type: Stratovolcano, Latitude: 7°32'30"S, Longitude: 110.442°E, Elevation: 2968 m (9,737 feet)
Mount Merapi is the most active volcano in Indonesia and has erupted regularly since 1548. Its name means Mountain of Fire. It is very close to the city of Yogyakarta, and thousands of people live on the flanks of the volcano, with villages as high as 1700 m above sea level. A very large eruption in 1006 is claimed to have covered all of central Java with ash. The volcanic devastation is claimed to have led to the collapse of the Hindu Kingdom of Mataram, however there is insufficient evidence from that era for this to be substantiated.
Mt. Etna, Sicily, Italy
Type: Stratovolcano, Latitude: 37°45.304′N, Longitude: 14°59.715′E, Elevation: 3,326 m

Mount Etna is an active volcano on the east coast of Sicily, close to Messina and Catania. It is the largest active volcano in Europe, currently standing about 3,326 m (10,910 ft) high, though it should be noted that this varies with summit eruptions; the mountain is 21.6 m (71 ft) lower now than it was in 1865. It is the highest mountain in Italy south of the Alps. Etna covers an area of 1,190 km² (460 square miles) with a basal circumference of 140 km. This makes it by far the largest of the three active volcanoes in Italy, being nearly three times the height of the next largest, Mount Vesuvius. Although it can occasionally be very destructive, it is not generally regarded as being particularly dangerous, and thousands of people live on its slopes and in the surrounding areas. The fertile volcanic soils support extensive agriculture, with vineyards and orchards spread across the lower slopes of the mountain and the broad Plain of Catania to the south. The mountain's regular and often dramatic eruptions made it a major subject of interest for Classical mythologists and their later successors, who sought to explain its behaviour in terms of the various gods and giants of Roman and Greek legend. Aeolus, the king of the winds, was said to have imprisoned the winds in caves below Etna. The giant Typhon was confined under Etna, according to the poet Aeschylus, and was the cause of the mountain's eruptions. Another giant, Enceladus, rebelled against the gods, was killed and was buried under Etna. Vulcan, the god of fire and the forge, was said to have had his forge under Etna and drove the fire-demon Adramitus out from the mountain, while the Cyclopes maintained a smithy there where they fashioned lightning bolts for Zeus to use as a weapon. The Greek underworld, Tartarus, was supposed to be situated beneath Etna. Its most destructive eruption occurred in March 1669, when an estimated 830,000,000 m³ of lava was ejected. The eruption was preceded by two months of increasingly powerful earthquakes centred on the southern slopes of the mountain, which eventually encouraged most villagers there to abandon their homes. On 11 March, a 9 km-long fissure opened up on the southern flank of the mountain, stretching from an elevation of 2800 m down to 1200 m. Activity steadily migrated downslope, and the largest vent eventually opened near the town of Nicolosi which was destroyed. The cinder cone built up at the erupting vent became known as Monti Rossi (red hills), and is still a prominent landmark today.

Laki
Type: Fissure Vents, Latitude: 64°03′53″N, Longitude: 18°13′34″W, Elevation: 813 m (2,667 feet)

On 8 June 1783, a fissure with 130 craters opened explosively at first because of the groundwater interacting with the rising basalt magma. Over time, the eruptions became less explosive, with the style changing from Plinian to Strombolian, and later to Hawaiian with high rates of lava effusion. This event is rated as VEI 4 on the Volcanic Explosivity Index, but the eight month emission of sulphuric aerosols resulted in one of the most important climatic and socially repercussive events of the last millennium. The eruption, also known as the Skaftafelldar (“Skaftá river fires”) or Siðueldur, produced about 15 km³ of basalt lava, and the total volume of tephra emitted was 0.91 km³. Lava fountains were estimated to have reached heights of 800-1400 m (~2,600-4,600 ft). In the United Kingdom, the summer of 1783 was known as the “sand-summer” due to ash fallout. The consequences for Iceland were catastrophic, approximately 25-33% of the population died in the famine of 1783 to 1784 after the fissure eruptions ceased. Around 80% of sheep, 50% of cattle and 50% of horses died because of fluorosis from the 8 million tons of fluorine that were released. An estimated 122 Tg (120 Million tons) of sulphur dioxide was emitted into the atmosphere: approximately equivalent to three times the total annual European industrial output in 2006, and also equivalent to a Mount Pinatubo-1991 eruption every three days. This outpouring of sulphur dioxide during unusual weather conditions caused a thick sulphurous haze to spread across western Europe, resulting in many thousands of deaths throughout 1783 and the winter of 1784. The summer of 1783 in Europe was the hottest on record and a rare high pressure zone over Iceland caused the winds to blow to the south west. The poisonous cloud drifted to Norway, then spread to Berlin by 18 June, and to the United Kingdom by 23 June. The fog was so thick that boats stayed in port, unable to navigate, and the sun was described as "blood coloured". In North America the winter of 1784 was the longest and one of the coldest on record. It was the longest period of below-zero temperature in New England, the largest accumulation of snow in New Jersey, and the longest freezing over of Chesapeake Bay. There was ice skating in Charleston Harbor, a huge snowstorm hit the south, the Mississippi River froze at New Orleans, and there was ice in the Gulf of Mexico.

Mt. Shasta, California
Type: Stratovolcano, Latitude: 41°24′33.11″N, Longitude: 122°11′41.60″W, Elevation: 4,179 ft

Mount Shasta, a 14,179-foot (4,322 m)[1] stratovolcano, is the second-highest peak in the Cascade Range and the fifth highest peak in California. The mountain is located in Siskiyou County, and has an estimated volume of 108 cubic miles (450 km³), making it the most voluminous stratovolcano of the Cascades. Physically unconnected to any nearby mountain, and rising abruptly from miles of level ground which encircle it, Mount Shasta stands some 10,000 feet (3,000 m) above the surrounding area. The mountain consists of four cones contained atop one another; these overlapping cones have built a complex shape making up the main body of the major summit. There are five named small glaciers clustered on the mountain's north side. In the last 8000 years, the Hotlum Cone (last cone to form) has erupted at least eight or nine times. About 200 years ago the last significant Shasta eruption came from this cone and created a pyroclastic flow, a hot lahar (mudflow), and three cold lahars, which streamed 7.5 miles (12 km) down Shasta's east flank via Ash Creek. A separate hot lahar went 12 miles (19 km) down Mud Creek. Mount Shasta can release volcanic ash, pyroclastic flows or dacite and andesite lava. There are fumaroles on the mountain, which show that Shasta is still alive. The worst case scenario for an eruption is a large pyroclastic flow, such as what occurred in the 1980 eruption of Mount St. Helens. Since there is ice, such as Whitney Glacier and Mud Creek Glacier, lahars would also result. Ash would probably blow inland, perhaps as far as eastern Nevada. There is a small chance that an eruption could also be bigger resulting in a collapse of the mountain, as happened at Mount Mazama in Oregon, but this is of much lower probability. The United States Geological Survey considers Shasta a dormant volcano, which will erupt again. It is impossible to pinpoint the date of next eruption, but it likely will occur within the next several hundred years.

Mt. Redoubt, Cook Inlet, Alaska
Type: Stratovolcano, Latitude: 60.4847° N, Longitude: 152.744° W, Elevation: 10197 ft (3108 m)

The 1989-90 eruption of Redoubt was the second most costly in U.S. history. Sent ash plumes over 12 km skyward. A Boeing 747 enroute from Amsterdam that flew into the ash cloud several hours after the eruption experienced complete engine failure and narrowly avoided tragedy when the crew successfully restarted the engines and safely landed in Anchorage. The resulting debris flow contained ice blocks as large as 10 m across and crested about 8 m above the river channel near the Drift River Oil Terminal, 35 km downstream.
Mt. Tambora, Sumbawa, Indonesia
Type: Stratovolcano, Latitude: 8.35°S, Longitude: 118.08°E, Elevation: 9,348 feet (2,850 m)
Mount Tambora (or Tombor) is an active stratovolcano on Sumbawa island, Indonesia. Sumbawa is flanked both to the north and south by oceanic crust, and Tambora was formed by the active subduction zones beneath it. This process raised Mount Tambora as high as 4,300 m (14,000 ft), making it one of the tallest peaks in the Indonesian archipelago, and drained off a large magma chamber inside the mountain. It took centuries to refill the magma chamber, its volcanic activity reaching its peak in April 1815. In 1815, Tambora erupted with a rating of seven on the Volcanic Explosivity Index; the largest eruption since the Lake Taupo eruption in AD 181. The explosion was heard on Sumatra island (more than 2,000 km or 1,200 mi away). Heavy volcanic ash falls were observed as far away as Borneo, Sulawesi, Java and Maluku islands. The death toll was at least 71,000 people, of which 11,000–12,000 were killed directly by the eruption. The eruption created global climate anomalies; 1816 became known as the Year Without a Summer. On 4 June 1816, frosts were reported in Connecticut, and by the following day, most of New England was gripped by the cold front. On 6 June 1816, snow fell in Albany, New York, and Dennyville, Maine. Such conditions occurred for at least three months and ruined most agricultural crops in North America. In the Northern Hemisphere, agricultural crops failed and livestock died, resulting in the worst famine of the 19th century. 1816 was the second coldest year in the northern hemisphere since AD 1400.

Krakatau, Sunda Strait, Indonesia
Type: Volcanic Caldera, Latitude: 6°6'7"S, Longitude: 105°25'3"E, Elevation: 813 m (2,667 feet)
Krakatau (Indonesian name: Krakatau, Portuguese name: Krakatoa) is a volcanic island in the Sunda Strait between Java and Sumatra in Indonesia. The name is used for the island group, the main island (also called Rakata), and the volcano as a whole. It has erupted repeatedly, massively and with disastrous consequences throughout recorded history. The best known eruption culminated in a series of massive explosions on August 26-27, 1883. The 1883 eruption ejected more than 25 cubic kilometres of rock, ash, and pumice, and generated the loudest sound ever historically reported — the cataclysmic explosion was distinctly heard as far away as Perth in Australia (approx. 1930 miles or 3100 km), and the island of Rodrigues near Mauritius (approx. 3000 miles or 4800 km). Atmospheric shock waves reverberated around the world seven times and were detectable for five days. Near Krakatau, according to official records, 165 villages and towns were destroyed and 132 seriously damaged, at least 36,417 (official toll) people died, and many thousands were injured by the eruption, mostly in the tsunamis which followed the explosion. The eruption destroyed two-thirds of the island of Krakatau. Eruptions at the volcano since 1927 have built a new island in the same location, called Anak Krakatau (child of Krakatoa).

Mt. Pelee, Martinique
Type: Stratovolcano, Latitude: 14°49′0″N, Longitude: 61°100′4″W, Elevation: 4,582 ft (1,397 m)
Mount Pelee (French: Montagne Pelée, "Bald Mountain") is an active volcano on the northern tip of the French overseas department of Martinique in the Caribbean. It is a stratovolcano, its volcanic cone composed of layers of volcanic ash and hardened lava. Mount Pelee is infamous for its 1902 eruption and the destruction that resulted, the worst volcanic disaster of the 20th century. The eruption caused about 26,000 to 36,000 casualties and destroyed Saint-Pierre. Though it was previously dormant, at least in living memory, Mount Pelee began to erupt on April 25, 1902. In early April, excursionists noted the appearance of sulphurous vapors emitting from fumaroles near the mountaintop. The main eruption, on May 8, 1902, on the Ascension Day, destroyed the town of Saint-Pierre, about 4 miles south of the peak. In the morning, people were observing the fireworks the mountain was showing off. It was 7:52PM; a cable repair ship had the city in direct view; the upper mountainside ripped open and a dense black cloud shot out horizontally. A second black cloud rolled upwards, forming a gigantic mushroom cloud and darkening the sky in 30 miles radius. The initial speed of both clouds was later calculated to be over 670 kilometers per hour. The horizontal pyroclastic cloud was hugging the ground, speeding down towards the city of Saint Pierre, appearing black and heavy, glowing hot from the inside. In under a minute it reached the city, instantly igniting everything combustible it came in contact with, covering the entire city. The cloud consisted of superheated steam and volcanic gases and dust, with temperatures reaching over 1000 °C. A rush of wind followed, this time towards the mountain. Then came a half-hour downpour of muddy rain mixed with ashes. Saint Pierre had a population of some ~28,000, which was swelled by refugees from the minor explosions and mud flows first emitted by the volcano. There were only two or three survivors. On May 20, a second eruption equal to the first one in both type and force obliterated what was left of Saint Pierre. The study of the causes of the disaster marks the beginning of modern volcanology with the definition and the analysis of the deadliest volcanic hazard: the pyroclastic flows.

Santamaria/Santiaguito, Guatemala
Type: Stratovolcano, Latitude: 14.756°N, Longitude: 91.552°W, Elevation: 12,372 feet
Volcán Santamaria is a large active volcano in the Western Highlands of Guatemala, close to the city of Quetzaltenango. Its eruption in 1902 was the second-largest eruption of the 20th century, and the third large eruption of that one year, after Mount Pelee in Martinique and Soufrière in St. Vincent. The 1902 eruption could be devastating is the collapse of Santamaria itself. The 1902 crater has left the southern flank of the mountain highly over-steepened, and a large earthquake or eruption from Santiaguito could trigger a huge landslide, which might cover up to 100 km².

Krakatoa seen from Santamaria.
Child of Krakatau
Santiaguito seen from Santamaria.
Paricutin, Mexico
Type: Cinder Cone, Latitude: 19.493° N, Longitude: 120.35° W, Elevation: 404 m
Paricutin is a volcano in the Mexican state of Michoacán, close to a lava-covered village of the same name. It appears on many versions of the Seven Natural Wonders of the World list. It started as a fissure in a cornfield owned by Tarascan Indian farmer Dionisio Pulido on February 20, 1943. Much of the volcano's growth occurred during its first year, while it was still in the explosive pyroclastic phase. Nearby villages Paricutin (after which the volcano was named) and San Juan Parangaricuturo were both buried in lava and ash. At the end of this phase after roughly one year the volcano had grown 336 metres tall. For the next eight years the volcano would continue erupting, although this was dominated by relatively quiet eruptions of lava that would scorch the surrounding 25 km² of land. The volcano's activity would slowly decline during this period until the last six months of the eruption, during which violent and explosive activity was frequent. In 1952 the eruption ended and Paricutin went quiet, attaining a final height of 424 metres above the cornfield from which it was born. The volcano has been quiet since. Like most cinder cones, Paricutin is a monogenetic volcano, which means that it will never erupt again. The volcano is unique in the fact that its formation was witnessed from its very conception. Amazingly not one recorded death was caused by the eruption, although three people died as a result of lightning strikes caused by the eruptions.

Mt. St. Helens, Washington
Type: Stratovolcano, Latitude: 46.20 N, Longitude: 122.18 W, Elevation: 9,677 ft before and 8,364 feet after eruption
At 0832 on May 18, a complex earthquake (M=5.1) shook the volcano, probably causing (but possibly caused by) a huge, 2.7-cubic-kilometer-landslide that in three different blocks successively removed the bulge and upper 400 meters of the volcano leaving a 600-meter-deep crater 2 kilometers wide rim-to-rim. The landslide quickly developed into a debris avalanche that sped at 110-240 kilometers/hour for 24 kilometers down the North Fork Toutle River. The avalanche buried the Toutle valley to a depth of nearly 50 meters. The landslide removed confining pressures where gas was rapidly released and superheated groundwater flashed to steam, causing a blast that exploded laterally from the collapsing north flank. The blast, called a "stone wind" knocked down most trees (the equivalent of about 150,000 houses) in a 600-square-kilometer area. Its maximum velocity may have been supersonic. In addition to causing havoc along the rivers themselves, lahars fed so much debris into the Columbia River that 31 ships were stranded in upstream ports until the 4-meter-deep channel was dredged to its pre-eruption depth of 12 meters -- the first in a series of similar dredgings to maintain Portland as a seaport.

Kilauea Volcano, Hawaii
Type: Shield Volcano, Latitude: 19°25′ N, Longitude: 155°17′ W, Elevation: 4,091 ft (1,247 m)
Kilauea volcano, on the southernmost Island of Hawaii, is one of the most active on Earth. It predominantly erupts basaltic lava in effusive eruptions, although occasionally it experiences explosive eruptions as well. Kilauea sits on the southeastern side of the Big Island of Hawaii, resting on the flanks of its larger neighbor volcano Mauna Loa. Kilauea shares the Hawaiian hot spot with its large active sibling Mauna Loa and with Loihi seamount. The Hawaiian Islands are composite of more than one. The Big Island, for instance, is constructed of 5 major volcanoes: Kilauea, Mauna Loa, Mauna Kea, Hualalai and Kohala. Mauna Loa is the largest active volcano on Earth. Kilauea is presently one of the most productive volcanoes on Earth (in terms of how much lava it erupts each year). The age of the volcanoes is thought to be due to the way in which the islands are built on the moving sea floor of the Pacific Plate that is moving at a rate of 5 to 10 cm/yr. As the plate moves over a fixed spot deeper in the Earth where magma forms, a new volcano can punch through this plate and create an island. As the plate moves away, the volcano stops erupting and a new one is formed in its place. With time, the volcanoes keep drifting westward getting older relative to the one active volcano that is over the hot spot. As they age, the crust upon which they sit cools and subsides. This, combined with erosion of the islands once active volcanism stops, leads to a shrinking of the islands with age and their eventual submergence below the ocean surface.

Mt. Pinatubo, Philippines
Type: Stratovolcano, Latitude: 15.13 N, Longitude: 120.35 E, Elevation: 1,745 m before and 1485 m after eruption
In June 1991, the second largest volcanic eruption of the twentieth century took place on the island of Luzon in the Philippines during a typhoon. Up to 800 people were killed and 100,000 became homeless following the eruptions, which climaxed with nine hours of eruption on June 15, 1991. The eruption plume of Mount Pinatubo's various gasses and ash reached high into the atmosphere within two hours of the eruption, attaining an altitude of 34 km (21 miles) high and over 400 km (250 miles) wide. This eruption was the largest disturbance of the stratosphere since the eruption of Krakatau in 1883 (but ten times larger than Mount St. Helens in 1980). The aerosol cloud spread around the earth in two weeks and covered the planet within a year. During 1992 and 1993, the Ozone hole over Antarctica reached an unprecedented size. The eruption is believed to have influenced such events as 1993 floods along the Mississippi river and the drought in the Sahel region of Africa. The United States experienced its third coldest and third wettest summer in 77 years during 1992.