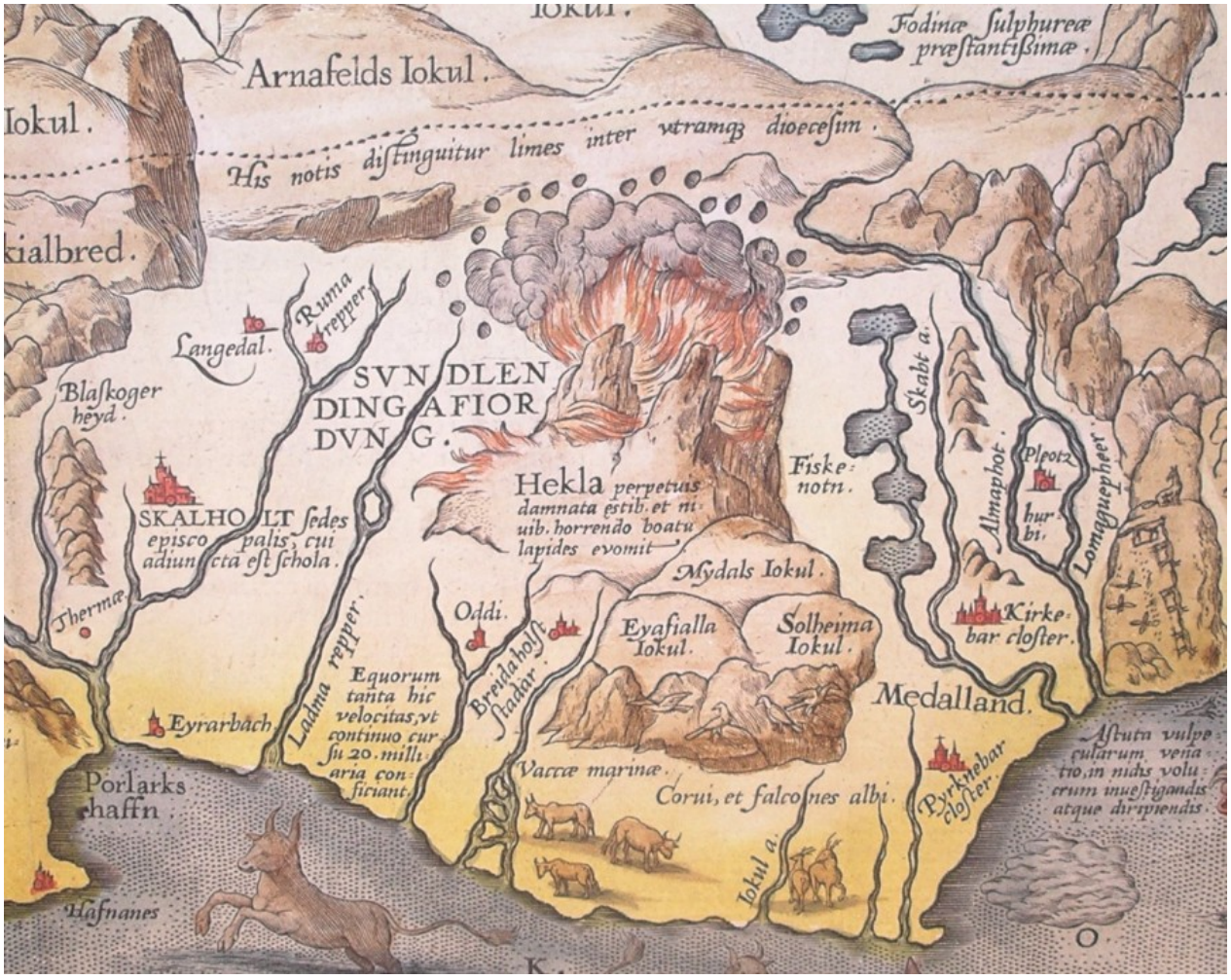
The History of Geology Newsletter

Number 1. March-April 2021



Flemish cartographer Abraham Ortelius publishes the first modern atlas in 1570. The map of Iceland includes the erupting Hekla as "gate to hell."

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Content

Many thanks for supporting the History of Geology Blog

Historic events in March:

March 1, 1833	The HMS Beagle arrives at the Falkland Islands, where Charles Darwin geologizes a bit and collects fossils.
March 2, 1933	The Sanriku earthquake and tsunami strike Japan, the country's most powerful earthquake in 180 years.
March 3, 1879	The United States Geological Service was officially established by the 45th U.S. Congress. Its task comprised land survey of the still poorly known west and prospecting for resources.
March 4, 1977	The strongest recorded earthquake (Mw 7.2) in European history strikes Bucharest, Romania. Tremors were felt as far away as Moscow and Rome. The quake killed about 1.578 people (1.424 in Bucharest alone) and wounded more than 11.300.
March 5, 2011	The Pu'u 'O 'o Crater Floor, Kilauea, Hawaii, collapses.
March 6, 2011	Kilauea's Kamoamoa fissure eruption starts. Lava poured out of the fissure until August 2014.
March 7, 1785	James Hutton presents his full theory of the Earth at a meeting of the Royal Society of Edinburgh.
March 8, 1979	The first extraterrestrial volcano is discovered, as an image taken by Voyager 1 probe of Jupiter's satellite Io shows a plume of volcanic material ejected into space.
March 9, 1847	Mary Anning dies at the age of 47. Her fossil discoveries were some of the most significant paleontological finds of all time
March 10, 1947	Mount Etna's lateral eruption ceases activity after one month. The eruption formed a series of splatter cones along a 6 kilometers long fissure.
March 11, 2011	A magnitude 9.0 earthquake shook the Tohoku region, causing a tsunami and killing 29.000 people.
March 12, 1784	Birthday of Victorian theologian and geologist William Buckland. He described the first dinosaur as Megalosaurus in 1824 based on a fragmentary jaw.
March 13, 2015	Died on this day, Polish palaeontologist Zofia Kielan-Jaworowska. She led Mongolian fossil expeditions revolutionizing our knowledge on Mesozoic mammals.
March 14, 1835	Charles Darwin sets off on an expedition into the Andes, where he collects fossils and sketches geology.
March 15, 1980	First underground tremors were recorded beneath the volcano Mount St. Helens in Washington State
March 16, 1834	HMS Beagle anchors at the recently British-acquired Falklands Islands. Charles Darwin will be the first naturalist to geologize there.
March 17, 1944	Mount Vesuvius began his last and most recent eruption in the midst of the battle for Italy.
March 18,	Died on this day, American paleontologist Othniel Charles Marsh. He gave us

1899	Brontosaurus, Stegosaurus, Triceratops... along with 83 other species and not to forget the great Bone War.
March 19, 1882	First stone laid for the Sagrada Familia in Barcelona. Spanish architect Antoni Gaudí i Cornet was inspired by geometrical shapes found in nature - like minerals - for his design.
March 20, 1980	The Pacific Northwest Seismic Network registers the first strong earthquake (M 4.1) at Mount St. Helens, one week later followed by ash and steam eruptions.
March 21, 1857	An earthquake strikes Tokyo (ancient Edo), killing 100.000 people.
March 22, 1831	German poet Johann Wolfgang von Goethe died on this day, but he was also mining engineer and geologist. He suggested some of the colors still used on geological maps and studied the geology of the Alps. Goethite was named after him.
March 23, 1769	Birthday of pioneering land surveyor and geologist William Smith, who is credited creating the first true geological map and introducing the concept of index fossils into stratigraphy.
March 24, 1905	Died on this day, French author Jules Verne. In 1864 he imagined a journey to Earth's center based on the geological knowledge of his time. On some ideas - like caves of giant crystals - he was far ahead of his time.
March 25, 1669	Mount Etna in Sicily erupts, destroying the town of Nicolosi, killing about 20.000 people.
March 26, 1961	The survey ship CUSS I makes its first drilling off the coast of Guadalupe Island as part of Project Mohole, an attempt to sample the oceanic lithosphere and the Mohorovicic discontinuity.
March 27, 1964	Alaska is shaken for 5 minutes by one of the strongest earthquakes in modern times, with M 8.3 – 9.2 after Richter (the quake was so strong that no seismometer in the affected area recorded it correctly). The quake killed 131 people.
March 28-April 4, 1982	Eruption of the El Chichón/Chichonal, the worst volcanic disaster in Mexico's recorded history. Pyroclastic flows and surges killed about 2.000 people, ashfall affected thousands more.
March 29, 1912	Last entry in Robert Scott's South Pole diary. The expedition ends in disaster as all members die, but the plant fossils - like Glossopteris - collected by the team will become another evidence for Wegener's continental drift.
March 30, 1759	In a letter the Italian mining engineer Giovanni Arduino (1714-1795) proposes the subdivision of Earth’s crust in various types of rocks - the first fundaments of the modern chronostratigraphic chart.
March 31, 1850	Birthday of Charles Doolittle Walcott, American invertebrate paleontologist famous for the description in 1909 of well-preserved Cambrian fossils in the Burgess Shale of British Columbia, Canada.

News of the Month:

Volcano erupts in Iceland

On March 21, 2021, NASA's Suomi NPP satellite acquired a nighttime view of western Iceland through a thin layer of clouds. Reykjavik, Reykjanesbær, and other cities appear as bright spots in the image. The eruption appears as a new patch of light on the southwestern part of the island.
- NASA Earth Observatory

After weeks of seismic activity with well over 50.000 earthquakes, a volcanic eruption has started on the evening of March 19, 2021 on the Reykjanes peninsula. The eruption started north-east of the town of Grindavík, in a valley called Geldingadalur near the Fagradalsfjall volcano, about 30 kilometers south from Reykjavík, the capital and largest city of Iceland. It is the first known eruption on the peninsula in about 800 years. Fagradalsfjall has been dormant for 6.000 years. The eruption has been called **Geldingadalsgos** (Geldingadalur eruption).

In the first days a 600–700-meter-long (2,000–2,300 ft) fissure vent began ejecting lava. Eventually a cone with two open volcanic vents formed, ejecting lava at a constant rate of 4 to 5 m^3/sec.

At the beginning of April, based on estimates by scientists at the University of Iceland, about 5.93 million m^3 of lava had erupted. The total area of the lava is about 30 hectares, or 300.000 m^2, with an average thickness of the lava of about 19,4 meters, but the greatest thickness is about 48 meters where the eruption started.

People watching the Geldingadalir eruption. - Wikipedia/Berserkur/CC BY-SA 4.0

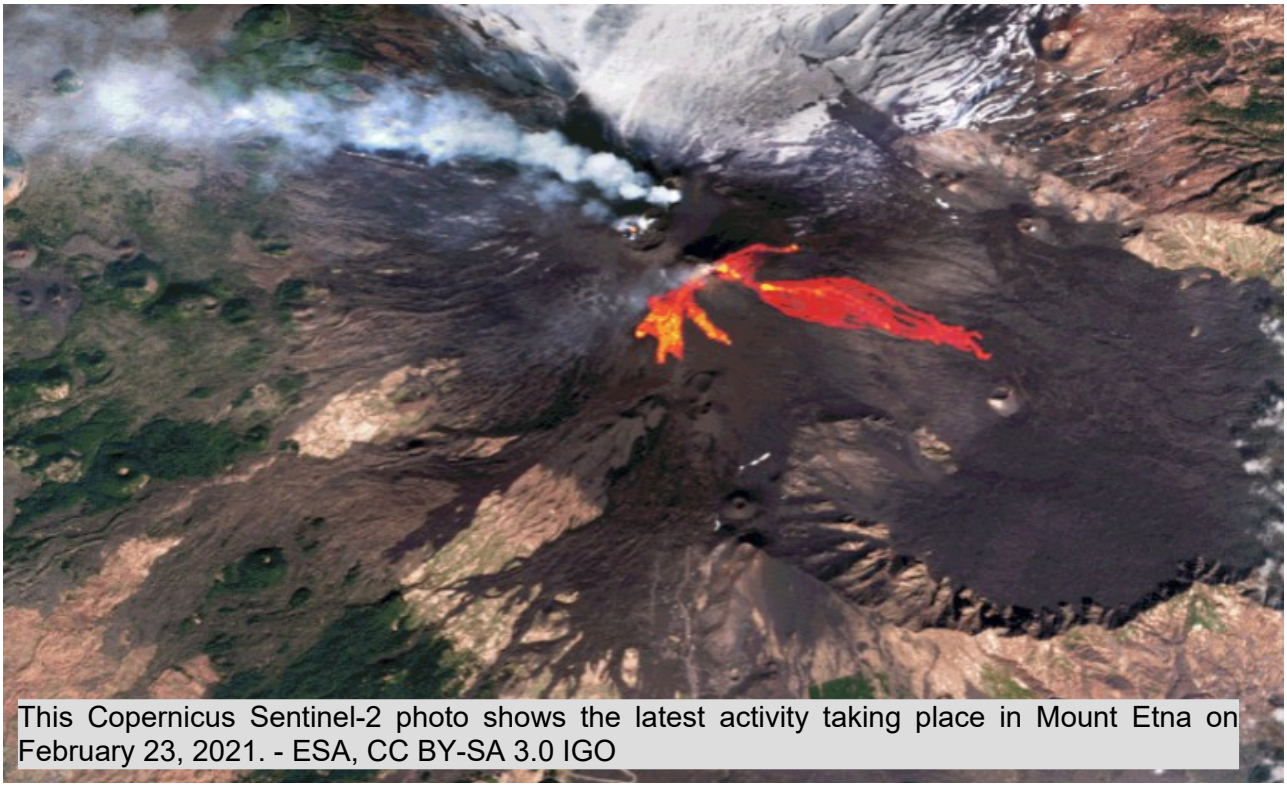
On 5 April a new 100-500 meters long fissure system, composed of three sections, opened north of the previous eruption site. The solidified lava formed a series of spatter cones as the effusion rate increased during the day. Traveling along a narrow gorge, the lava flow reached in less than two hours the bottom of Meradalir, a valley northeast of Geldingadalir, approximately one kilometer to the east-northeast. On 7 April a third fissure opened about halfway between the two sites of the earlier eruptions.

Currently, the lava flows pose no threat to residents, as the area is mostly uninhabited, although there is potential for sulfur-dioxide and ash pollution. Based on estimates of the magma volume underground, the eruption could go on for weeks.

Around 30.000 people have visited the area since the eruption began, according to the Icelandic Tourist Board.

Mount Etna in Italy erupts

Italy's Mount Etna, Europe's most active volcano, has recently been on explosive form, with 17 eruptions in less than three months. Located on the east coast of Sicily, Mount Etna is one of the world's most active volcanoes. Its eruptions occur at the summit, where there are four craters: the Voragine and the Bocca Nuova, formed in 1945 and 1928 respectively, the Northeast Crater, the highest point on Etna (3330 meters) and the Southeast Crater, which has recently been the most active of the four. Starting in February 2021, the Southeast Crater produced a series of intense lava fountains coloring the night sky in hues of orange and red. Over the course of the following weeks, the volcano produced lava fountains reaching as high as 1.5 km. These spectacular explosions are amongst the highest observed at the Southeast Crater in recent decades. In the past, lava fountains reaching the same height were only observed at the Voragine crater in December 2015 – with lava fountains of over 2000 meters.[1]



This Copernicus Sentinel-2 photo shows the latest activity taking place in Mount Etna on February 23, 2021. - ESA, CC BY-SA 3.0 IGO

1 Satellites Monitor Unpredictable Explosive Behavior of Mount Etna – Europe's Most Active Volcano. European Space Agency (ESA) April 12, 2021

The Laki Eruption

“The flood of fire flowed with the speed of a great swollen river with meltwater on a spring day,...[] Great cliffs and slabs of rock were swept along, tumbling about like large whales swimming, red-hot and glowing.” - Jón Steingrímsson

In 1783-1784 the Laki eruption on Iceland produced one of the largest basaltic lava flows in recorded history.

Center of the Laki Fissure. - Wikipedia/Chmee2/Valtameri/CC BY-SA 3.0

The eruption that began on June 8, 1783, in the southern district of Síða was something unusual even for a land of volcanic origin like Iceland. In the next eight months, an estimated 14 km³ of lava poured out from 135 fissures and volcanic craters near the town of Klaustur. The lava from the fissures ended up covering an estimated 2,500 km² of land, which threatened to overrun not only many farms but also the entire town. The newly formed chain of volcanoes was named later Laki.

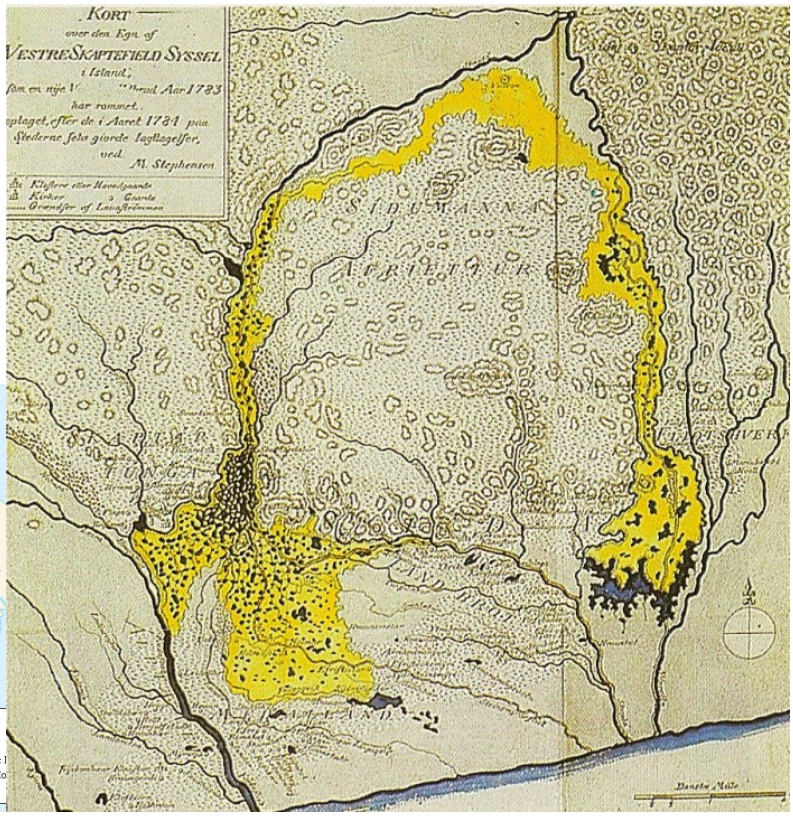
Jón Steingrimsson[2] a priest in Klaustur, covered the developing disaster in his diary, including careful observations of the volcanic activity and personal tragedies, like the death of his wife and many of his community due to starvation caused by the ash and volcanic gases destroying the crop and killing the livestock.

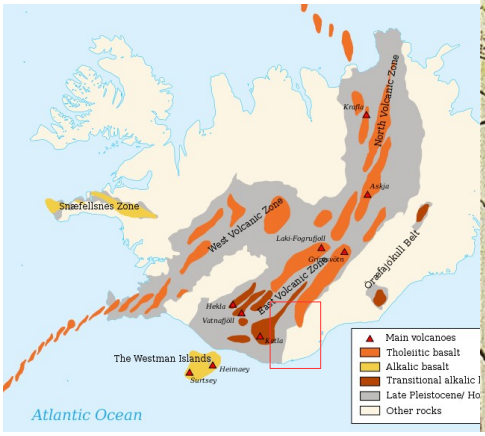
The first explosion happened in the morning of Sunday, June 8, as Jon was getting ready for the church service. Ash covered the sky and the Skafta river near the town began to dry up, The lava appeared in the lowlands on June 12, having come down the now dry Skafta canyon. The following Sunday, some of the local farmers trekked into the highlands,

2 Albert (20/05/2020): Laki: the making of a fire. Volcano Café https://www.volcanocafe.org/laki-the-making-of-a-fire/

climbing a peak to get a view of the events. They were the first (and only?) to see the rift in action, reporting twenty fountains of fire.[3] Four day later, the fissures northeast of Mount Laki opened up, with a major explosion on July 29. The new lava flows came down the Hverfisfljot river, east of the town. By August 3 this river no longer flowed, and on August 7 lava appeared in the lowland. Klaustur was now surrounded by lava. Fortunately, the approaching lava stopped during the famous fire mass held by Steingrimsson in his church and the town was save. The eruption continued until February 1784, even if the lava effusion gradually diminished.

Map published in Magnus Stephensen's "Kort Beskrivelse: Vester-Skaptefields-Syssel paa Island" (1785) showing the lava flows of the Laki eruption moving towards the sea and surrounding the town of Klaustur.
- Public Domain





It tuned out, however, that the lava wasn't the only threat. Volcanic ash from the eruption was carried away by the wind and poisoned the land and sea. Animals suddenly developed "ridges" and "growths" on their legs. Observers also noted they became "bloated" and their mouths swelled. This "pestilence" – likely a severe fluorine-intoxication from the ash - killed half of the Icelandic cattle population and a quarter of the sheep and horse population.
Nothing would grow on the fields and no more fish could be found in the sea. If not protected from the ash, food and water became poisonous. Jón Steingrímsson described also the strange sickness, probably caused by the element fluorine found in volcanic ash, affecting the people.

"Those people who did not have enough older and undiseased supplies of food to last them through these times of pestilence also suffered great pain. Ridges,growths, and bristle appeared on their rib joins, ribs, the backs of their hands, their feet, legs, and joints. Their bodies became bloated, the insides of their mouths and their gums swelled and cracked, causing excruciating pains and toothaches."

In the resulting plague and famine from 1783-1784, an estimated 9.000 people -one-fifth of the population of Iceland -died.

3 Following their example, these types of eruptions are now called "fires".

But the Laki eruption had possibly even more widespread effects. In the months after the eruption, a strange haze covered the sky above Europe, making breathing difficult.

As the ash and gases from the Laki eruption entered the high layers of the atmosphere, they absorbed moisture and sunlight, changing weather patterns.

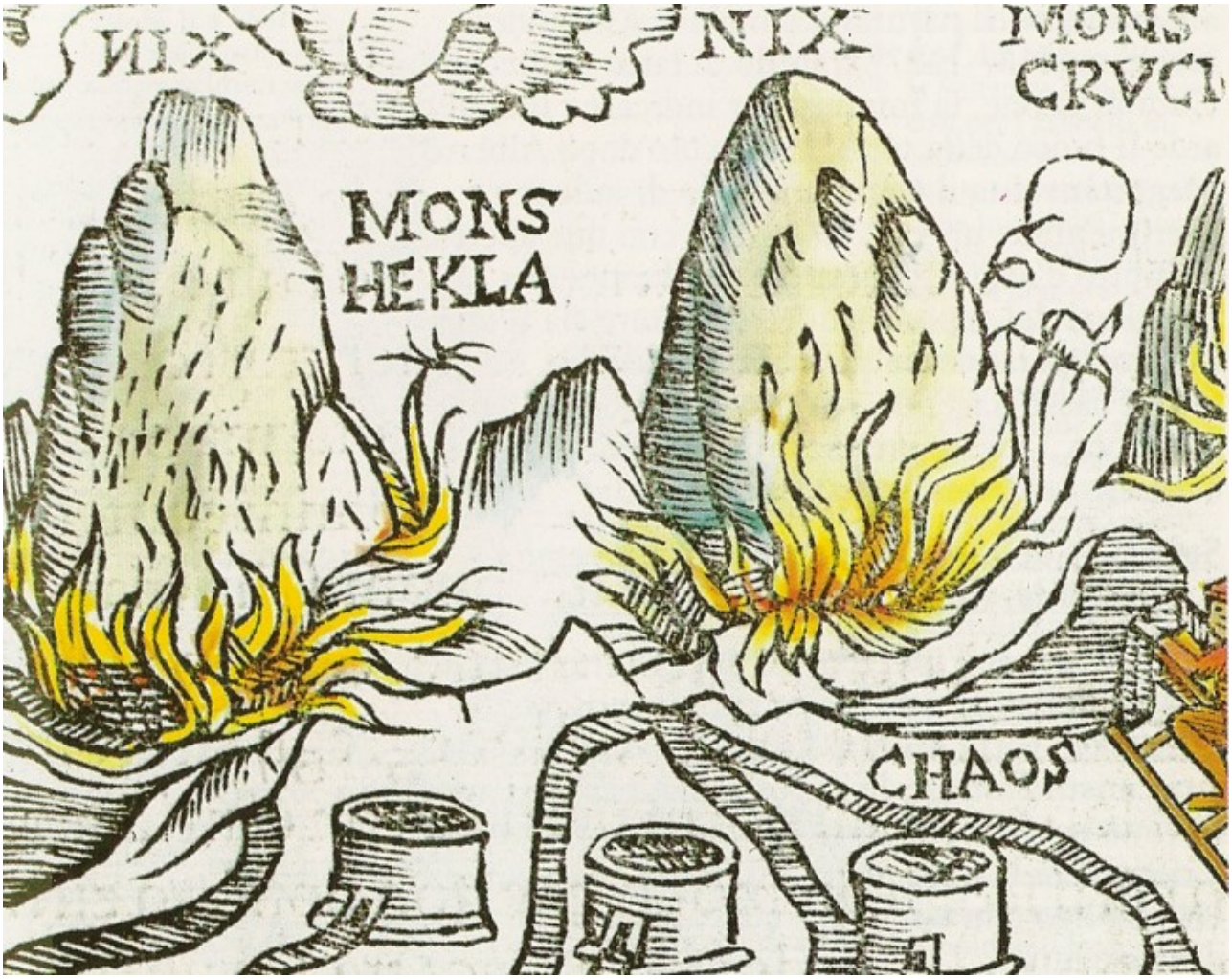
From 1783 to 1785 accounts from both Japan and America describe terrible droughts, exceptional cold winters, and disastrous floods. In Europe, the exceptionally hot summer of 1783 was followed by long and harsh winters.[4]

It's a sobering reminder that destructive changes to the environment can have long-lasting and far-reaching impacts, even from hundreds of miles away.

4 WITZE, A. & KANIPE, J. (2014): Island on Fire: The extraordinary story of Laki, the volcano that turned eighteenth-century Europe dark. Profile-Books: 224

Volcanoes in the Icelandic Sagas

Medieval Icelandic literature doesn't make a lot of references to the unique geological features that Iceland is so famous for among modern tourists.



The Hekla is one of the most active volcanoes in Iceland. Since the year 1104, when the mountain erupted with one of the most powerful eruptions in Iceland's history, more than 160 eruptions were recorded. - Olaus Magnus (1555) “Historia de gentibus septentrionalibus.”

Iceland is famous among modern tourists as the land of ice and fire. The island is located on a section of the Mid-Atlantic Ridge - the boundary between the North American and Eurasian tectonic plates – rising above the sea. Iceland is home of 130 volcanoes, 30 are still active and Icelanders experience an eruption once every 4 to 5 years. But surprisingly enough, Icelandic medieval literature does rarely reference such events. Some scholars argue that the sagas - a collection of Icelandic stories written around the year 1200 - didn't include eruptions as they were so commonplace to Icelanders, that there was simply no reason to talk about them. But volcanic eruptions are still unique events shaping entire landscape. It is important to note that Icelandic literature is heavily focused on human

stories. Landscape features and places play a role as a story setting, but are not the focus.[5] Volcanic events are only of importance, if they somehow effect the people's lives.

In the year 930, the world's oldest parliament, the Alþingi (or Althing), was established in Iceland. Meetings of the Althing were held in a large graben-structure formed by tectonic movements along the Mid-Ocean-Ridge crossing the volcanic island. Along the spreading center the toppling of large fault blocks forms steep rock cliffs in the basaltic lava highlands. Supposedly the cliffs created the perfect acoustics to speak to large crowds of people by reflecting the human voice.

During a meeting in the Althing, the clan leaders argued if all Icelanders should adopt the new religion of Christianity, when a messenger brought the news about the eruption of a volcano near the farm of Hjalli, some kilometers to the south. Some argued that the eruption was a sign of disapproval by the ancient gods. "It's no wonder that there has been an eruption there. The gods are enraged!" the crowd shouted. But the Christian leader Snorri, pointing to the vast lava fields surrounding the Althing, exclaimed: "Clearly the christian god punished the Icelanders by covering the land with lava when they were still all pagans, long before the ancient gods did it today!" Convinced by the power of the new god, Icelanders adopted the Christian faith. The eruption of Hekla in 1104 inspired the idea of volcanoes as gates to hell. This saga also shows that Icelanders were aware of the volcanic origin of their island.

The 13th century Ìslendinga saga mentions a "Fire erupted off the coast of Reykjanes", likely an eruption in 1210 to 1240 on the Reykjanes peninsula, site of an eruption also in 2021. The eruption caused a "sand-summer" and "grasslessness", the description of how volcanic ash-fall covers the fields and pastures. As this ash killed the livestock and destroyed the harvest, in the end causing starvation among the people, the event was important enough to be included in the saga.

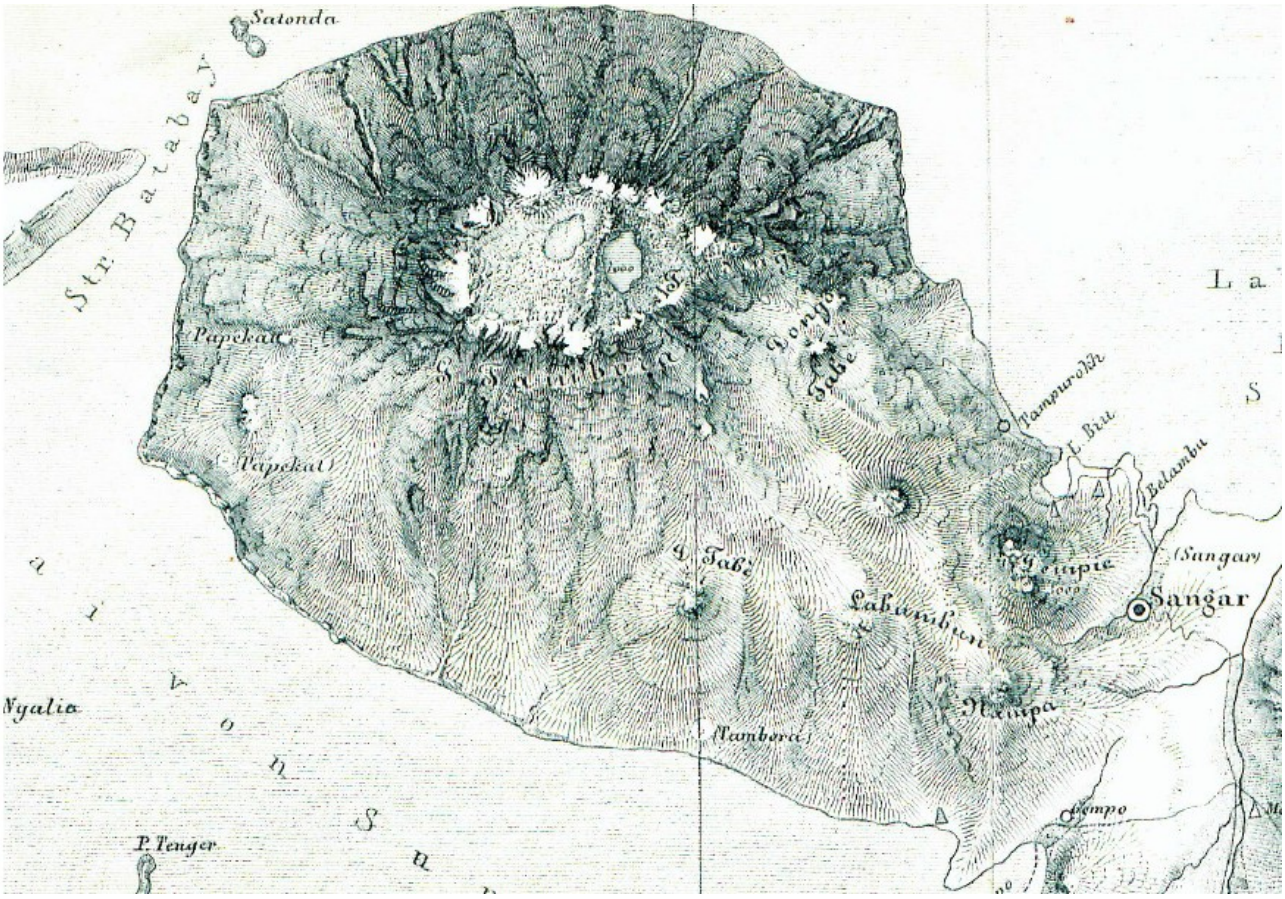
In "The Tale of the Rock-Dweller", dating to the 14th century, a short poem is mentioned. Even if other interpretations are possible, the translation by Marvin Taylor assumes that the poem is talking about a volcanic eruption:

"Stones fly at the giant step,
steep cliffs tilt and teeter, ...
Dark flames spit and drive,
split the mountain ridge,
harsh rumble around
Embers shoot, I say,
rushing, black straight upwards.
Round Hrungnir's hall is heard,
the roaring of the spark storm.
Crags and boulders burst,
bringing death to many.
Tremors rack the landscape,
resounding in the mountains."

5 Saga Stories #5: Volcanoes in the Sagas. Youtube/The Reykjavík Grapevine https://www.youtube.com/watch?v=kZxShsGf99I

What if a Supervolcano erupts?

The Volcanic Explosivity Index (VEI) is a relative measure of the explosiveness of a volcanic eruption running from 0 to 8. The most powerful eruption in modern history is the 1815 eruption of Mount Tambora in Indonesia with a VEI 7. A VEI 8 is the eruption of a supervolcano.



Map by German botanist Heinrich Zollinger, who visited the Tambora on the Indonesian island of Sumbawa (Indonesia) in 1847. The huge summit caldera - 6 kilometers in diameter and 1.100 meters deep - formed when Tambora's estimated 4.000-meter-high peak was removed, and the magma chamber below emptied during the 1815 eruption. Today the crater floor is occupied by an ephemeral freshwater lake, recent sedimentary deposits, and minor lava flows and domes emplaced during the 19 and 20° centuries. Layered tephra deposits are visible along the north-western crater rim. Active fumaroles, or steam vents, still exist in the caldera. - Public Domain

One of the most famous supervolcanos in the world is the Yellowstone Caldera in the U.S.. Yellowstone is known to have had two VEI 8 eruptions in the past (some 2.1 million and 640.000 years ago).

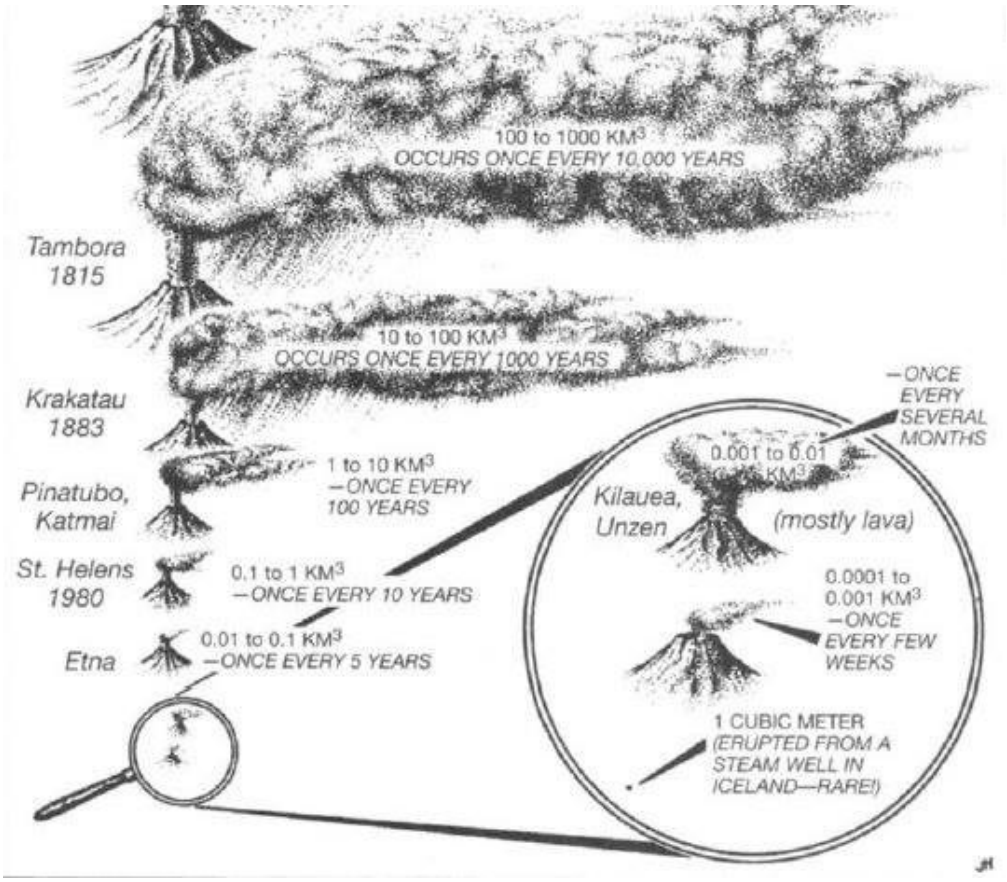
A study published by BRENNA et al in January 2021[6] sheds some light over what happens when such a supervolcano erupts. The researchers studied the impact of the supervolcano

6 BRENNA, H. et al. (2021): Decadal Disruption of the QBO by Tropical Volcanic Supereruptions. Geophysical Research Letters

of Los Chocoyos on Earth's atmosphere. Los Chocoyos is one of the most recent VEI 8 supereruptions, happening approximately 75.000 years ago in the Guatemalan highlands. Today, the eruption site is an enormous lake, the Atitlán Caldera, surrounded by three cone-shaped volcanoes: the Atitlán, the Tolimán, and the San Pedro.
The researchers tested different volcanic forcing scenarios, lasting several years and with a peak in volcanic emissions. According to their results, the eruption of a supervolcano – at least one located near the equator - can have the power to temporarily change the wind regimes in the tropical stratosphere and change weather patterns in both hemispheres for years, more likely for decades. Such powerful eruptions are believed to happen once every 1.000 to 100.000 years.

In 1820 the police officer Graf Welsperg-Raitenau of the Austrian town of Salzburg wrote in an official report, that *"the glaciers have destroyed ground in the Tauern mountains, once fertile pasture for the cattle", adding "I´m convinced that the climate is deteriorating … and so the Alps are becoming more of a wilderness."* Little could the officer know that a volcano was to blame for the strange weather experienced at the time.

The VEI 7 eruption of Tambora near the equator in Indonesia on April 10, 1815, ejected so much volcanic gases and dust into Earth's atmosphere that temperatures dropped worldwide. The summers of 1816 and 1817 were cool and rainy, especially in the Alps, it was the coldest summer in the last 1.200 years.
Floods, storms and snowfall in June destroyed harvests in Europe and America, and 1816 was named the year without a summer. In Asia, droughts were widespread. The starving people were easy prey to parasites and diseases. In the worldwide famine and plagues following the eruption of Tambora, more than 200.000 people died.



The size of a volcanic eruption is measured with the Volcanic Explosivity Index (VEI). Based mainly on volumes of erupted material this scale comprises eight magnitudes. - USGS

Two centuries after the last VEI 7 eruption, would humanity be ready for another one? Since 1815, the world's population has grown exponentially and today more than 800 million people are living within sixty miles of an active volcano. During a VEI 7 eruption pyroclastic flows (or pyroclastic density currents - PCDs) would annihilate any life in a radius of thirty to sixty miles. Tsunami waves could travel hundreds to thousands of miles over the sea. In densely populated urban areas twenty to thirty million people would be at risk by such an eruption.

As there is no protection against PCDs and only limited protection against tsunami, evacuation in time would be the only solution. This poses not only logistical problems, but could also cause political tensions, as the refugees would need accommodation and support for an indefinite period of time. The most disastrous effects of a VEI 7 eruption would last probably only a few days to weeks. However, the ash fall would bury buildings and severely impact infrastructures like streets, power and communication lines. The volcanic material would poison and destabilize the ground, and landslides and mudflows would still be possible for years, making it difficult to settle in the area again.

Apart from direct local effects, a Tambora sized eruption would also have global repercussions, both on the climate and on modern international air traffic, human health, financial systems and communications.

The VEI 3 eruption of the Icelandic volcano Eyafjallajökull in 2010, with an ash volume of just 0,25 km3, lead to the closure of the airspace above Europe for eight days, causing an estimated US$ 5 billion in economic losses. A VEI 7 eruption, with 400 times the ash volume erupted by Eyafjallajökull, would probably have a disastrous impact on global air traffic. In our globalized world, the disruption of traffic for products and people could have worldwide economic repercussions. For example, the Tohoku earthquake in March 2011 caused a worldwide shortage of spare parts for automobiles, as many important industrial sites in Japan were damaged, traffic lines interrupted and airports or harbors destroyed.

The impacts of volcanic ash on human health depends strongly on its chemical properties. From Tambora, there are no records about health issues caused by the ash or gases, but after the eruption of Laki in Iceland (1783) one-fifth of the population died, probably also from fluorine poisoning. Traces of fluorine in the ash, covering fields and washed into the drinking water, can poison animals and people and cause serious tissue degeneration.

Poorly studied, as there are no precedents, is the impact of a VEI 7 volcanic eruption on modern communication. Ash particles can become electrically charged during the eruption. Dispersed into earth's atmosphere the particles can disturb radio signals, limiting local communication. Also, the Global-Position-System, based on satellite signals and today essential for navigation, could become useless in regions with ash contamination in the higher layers of Earth's atmosphere.

The explosive VEI 6 eruption of Mount Pinatubo in 1991 caused local devastation and a global cooling effect by 0,5°C in the following two years. The Tambora eruption was ten times stronger and caused the following years 1816 and 1817 to be unusually cold, with wet summers and harsh winters.
Modern agricultural production, though much more efficient than in 1816, still strongly depends on the weather. The warming caused by anthropogenic carbon-dioxide emissions into earth's atmosphere will continue for the next centuries. Some research has suggested that a warmer climate will fuel future conflicts. In such an unstable climate, further disruption can quickly escalate. For example, droughts can quickly cause water and food shortage in less developed countries and even industrialized nations can be

negatively impacted. In 2010, droughts in Russia and too wet weather in Europa caused a 20% loss of harvest. Countries like China, also suffering from a poor harvest, stocked crops. Prices for food in response quickly skyrocketed on the international market by 40 to 70% (with financial speculation also playing a role). The increased living costs, widespread unemployment and general misery lead to riots and demonstrations in many countries. Civil wars in Africa and the Near East caused mass migrations of refugees to the first world countries. This has led to social discontent in Europe and politics is still struggling today with the aftermath of 2010. However, it's not entirely clear if a Tambora sized eruption would be as disastrous to the climate today as in 1815. The cooling caused by Tambora happened in the already cold climate of the Little Ice Age. Today, in a warmer climate, the cooling would be weaker on a global scale, but probably still cause disruptions of weather patterns.

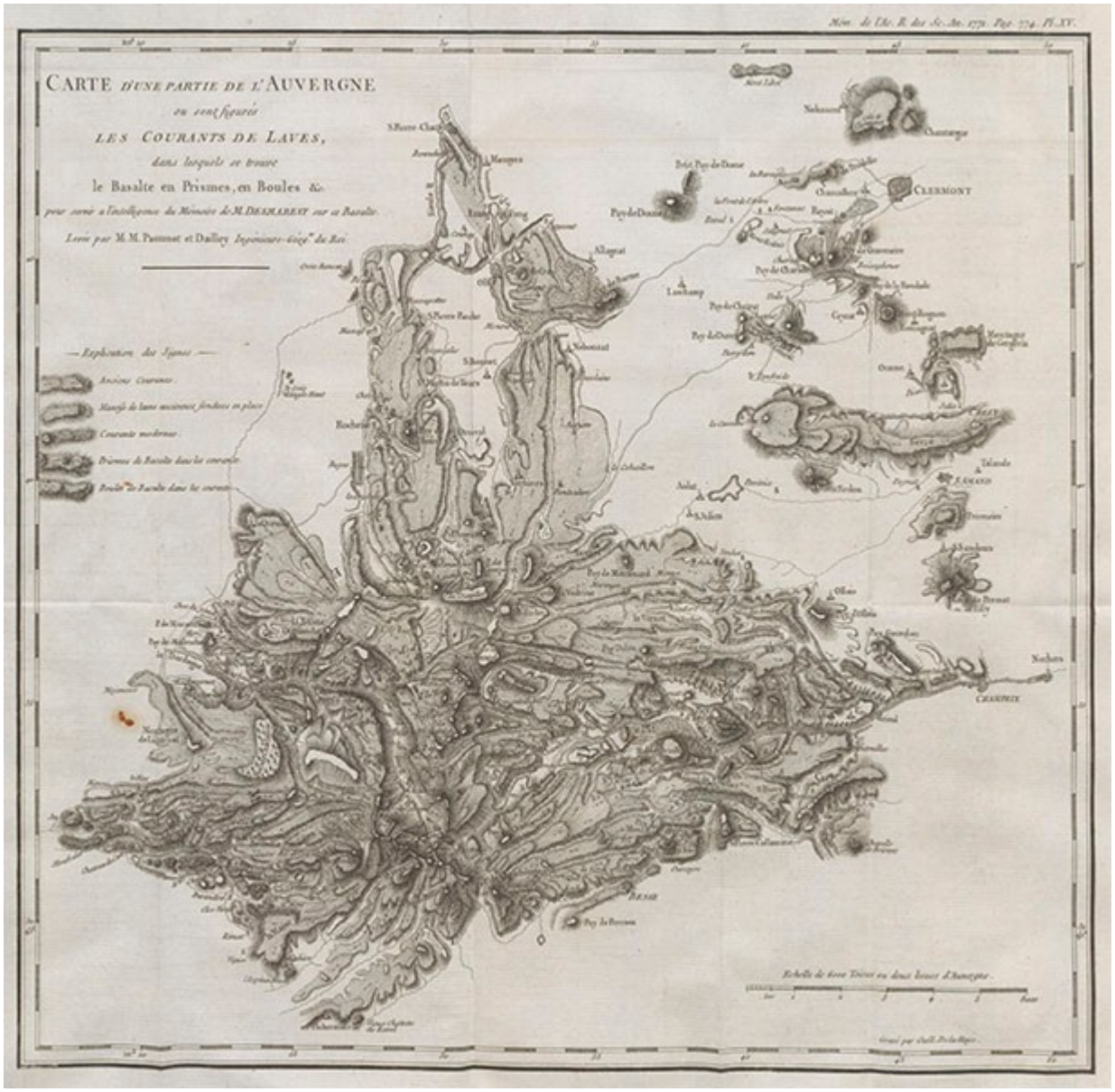
Geologists have mapped over one-hundred volcanoes (including the still active Tambora) that could produce a VEI 7 or even VEI 8 eruption. The areas most at risk, densely populated and where such supervolcanoes are found, are located around the Pacific Ocean (the notorious "Ring of Fire"), Indonesia and the Mediterranean Sea.[7]

Even if our society is still potentially vulnerable, there is an important difference between 1815 and 2021. At the time geologists had a very poor understanding of how volcanoes work. An eruption of a supervolcano would most likely announce itself months or weeks ahead of time. Forward-thinking governments should plan for such a hypothetical, but not impossible event already today. A good start is to invest in monitoring and research, especially of poorly studied volcanoes. City planners and engineers should plan ahead, adopt anti-seismic building regulations and consider possible evacuation routes. Education should include the awareness of the possible risks and teach the right response in case of disaster. Media should do their work to inform. Authorities and governments should invest in relief efforts and international cooperation. In the long term, such investments could result valuable also without a disaster happening.

7 NEWHALL, C. et al. (2018): Anticipating future Volcanic Explosivity Index (VEI) 7 eruptions and their chilling impacts. Geosphere 14 (2): 572-603

The early geological mapping of volcanic terrains

Volcanic deposits posed a challenge to early geologists trying to map them.



The image is from Nicolas Desmarest, a French geologist whose early explorations of the then remote Auvergne volcanoes in south central France showed how lava flows are connected to volcanic craters, proving the volcanic origin of basaltic rocks (still disputed at the time).

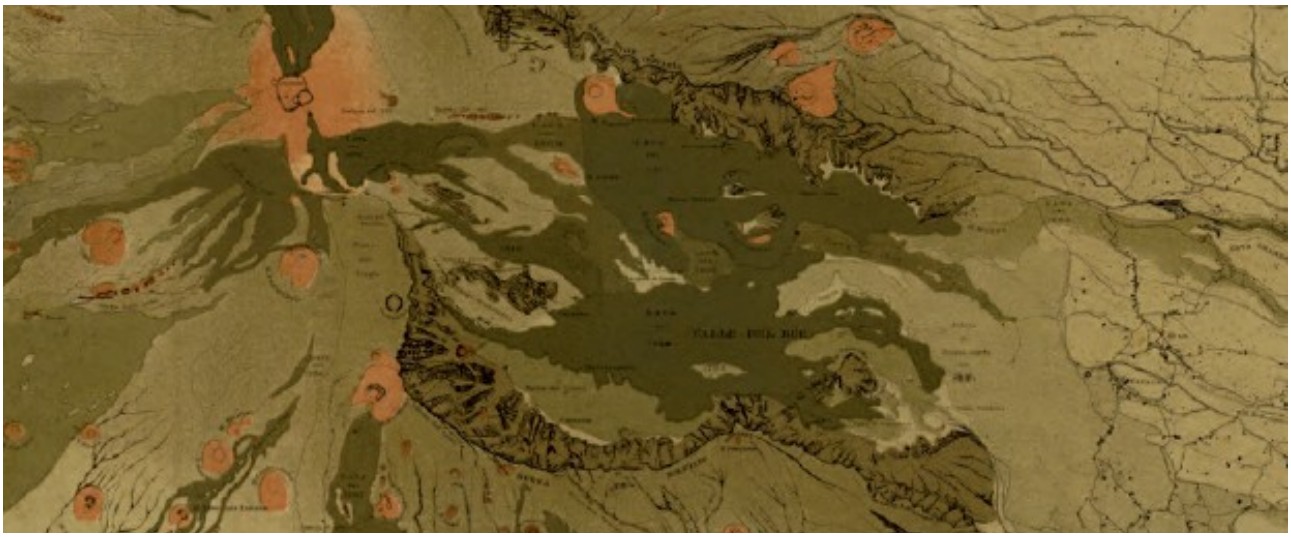
Maps showing the distribution of rock outcrops were already produced in the 18th century, however, the first true geological maps - showing the area of occurrence of specific rock strata - were only widely published after 1815. The earlier, simpler maps had few categories in legends, often using only black and white signatures. For example, in 1771 French geologist Nicolas Desmarest used five categories to describe volcanic rock

formations (like basalt columns, lava flows and pillow lava) in the Monts Dore massif in Auvergne in a map published in 1771.

Colors began to be used as a standard to depict rock strata as soon as printing technology advanced and color prints became cheaper. But mapping of volcanic rocks proved to be difficult.

Volcanic deposits share some similarities to sedimentary successions, yet are treated differently.[8] Most volcanoes supply large volumes of material during one large eruption or over time in a series of smaller eruptions. Geological units of a volcano can be mapped based on properties of the rocks and age of deposition. But the distinction is not always clear. For example a pyroclastic flow can produce rocks with different properties (like clast size) during the same event. Before modern dating methods using the radioactive decay of elements in magmatic minerals were available, the age of a lava flow was often estimated from vegetation cover or based on records of historic eruptions. Such methods were quite imprecise, adding to the confusion.

In 1838 French mineralogist Elie de Beaumont used three color to distinguish between different ages of lava flows at Mount Etna. The colors were painted by hand on the printed map. Ten years later, German geologist Wolfgang Sartorius von Waltershausen used different shades of green to distinguish volcanic deposits of varying age. However, the different volcanic cones (shown in yellow) associated with the lava flows were all included in one category, with no distinction of age. His map was widely criticized by the scientific community as confusing.



Geological map published in 1848 by German geologist Wolfgang Sartorius von Waltershausen (1809-1876) that describes for the first time the geology of the summit region of Mount Etna and the Valle del Bove. Mount Etna, one of the most active volcanoes in the world, is located at the eastern coast of Sicily in one of the most densely populated areas of the Mediterranean basin.

8 NEETH, K. & PALMER, J. (2019): Geological mapping of volcanic terrains: Discussion on concepts, facies models, scales, and resolutions from New Zealand perspective. Journal of Volcanology and Geotherma Research

There was no standard to use certain colors for specific rocks. Some geologists used the color of a rock formation as template, for example red color for red-colored sandstone. Shades of grey or black were used for dark lava rocks. But in many cases it was impossible to map all variations of age of a certain rock type using only one color. The confusing and inconsistent use of colors made it also impossible to compare geological maps from different authors.

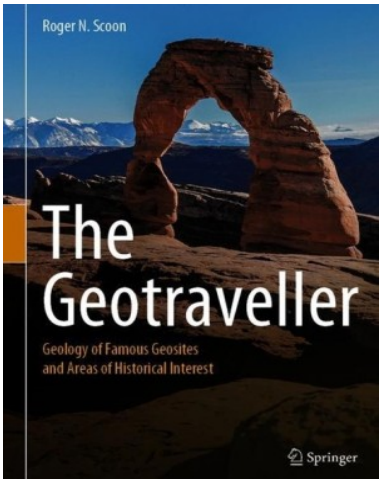
Only in 1881, during the International Geological Congress in Bologna, geologists finally agreed to use the color red to represent volcanic deposits on geological maps.[9]

Detail of the National Geological Map of Italy published in 1884, showing the summit region of Mount Etna. The use of different shadows of the color red, in combination of different signatures, is adopted to show lava flows dating to different centuries, to reduce the number of categories.

Modern maps are still based on this standard, but to increase readability, a more distinct color scale, ranging from yellow-orange-red, is preferred.

9 ABATE, T. & BRANCA, S. (2018): L'introduzione del colore per la rappresentazione dei prodotti vulcanici: il caso della cartografia geologica dell'Etna nel XIX secolo. Rend. Online Soc. Geol. It.

Book Reviews



Roger Scoon (March 2021): Geology of Famous Geosites and Areas of Historical Interest.

This book describes famous geosites and historical localities in national parks and conservation areas from North America, East Africa, and Europe on 358 pages with photographs, illustrations and simplified geological maps. Some of the geosites and historical localities provide evidence that previous civilizations coped with active geology and major climatic cycles, whilst others reveal evidence of famous geological events recognized in history and ancient mythology that helped shape our current civilization.

Darren Naish (September 2021): Dinopedia: A Brief Compendium of Dinosaur Lore.

Dinopedia is essentially a guide to our modern understanding of Mesozoic dinosaurs, combining thoughts on dinosaur diversity and evolution, the people who study, illustrate or promote Mesozoic dinosaurs, and various relevant cultural and scientific events.

Mineral Story

Heulandite (a Ca-Zeolite) on lava matrix from Fassa, Italian Dolomites. This specimen comes from the collection of British landowner, brewer and mineral collector Isaac Walker (1794-1853) as the original label reveals. Walker used a code to keep basic information for every single mineral specimen in his collection. "H" stands for Henry Heuland (1778-1856), a German-born English mineralogist and dealer. Walker repeatedly acquired minerals from Heuland and this specimen is dated to an acquisition made in 1816. Heulandite was recognized as a distinct mineral only in 1818 and named after Heuland in 1822, so here it is still labeled as "red stilbite" (a Ca-Na-zeolite).
The Fassa valley is still today a famous site among mineral collectors. The vugs - small to medium-sized cavity inside rock - in the Triassic pillow-lava outcrops found here are partially filled with crystals, like analcime, natrolithe, quartz and heulandite.