

Vulcanism and 13th Century Weather

Michael Tighe
Arlington, MA

Michael of York
Carolingia, East Kingdom

References

- **Matthew Paris's English history. From the year 1235 to 1273.** Translator: J.A. Giles. London, 1889
- **Source of the great A.D. 1257 mystery eruption unveiled, Samalas volcano, Rinjani Volcanic Complex, Indonesia** – Lavigne et al. Proceedings of the National Academy of Sciences of the United States of America, Oct 15, 2013 , vol. 110 no. 42 16742-16747, doi:10.1073/pnas.1307520110
- Fischer, E. M., J. Luterbacher, E. Zorita, S. F. B. Tett, C. Casty, and H. Wanner (2007), **European climate response to tropical volcanic eruptions over the last half millennium**, Geophys. Res. Lett., 34, L05707, doi:10.1029/2006GL027992.
- Stothers, Richard B., **Climatic and Demographic Consequences of the Massive Volcanic Eruption of 1258**, Institute for Space Studies, Goddard Space Flight Center, NASA, 2880 Broadway, New York, NY 10025, U.S.A
- **Museum of London Archeology (MOLA)** reports on 1991-2007 excavation of Spitalfields market, the site of the Augustinian priory and hospital of St Mary Spital (ISBN: 1901992004 and ISBN: 9781907586118).
- **Tambora – The Eruption that Changed The World** by Gillian Darcy Wood, © 2014, Princeton University Press, New Jersey. ISBN: 9780691150543.
- **Wikipedia, Google Books** and the internet in general

Matthew Paris and the Volcano

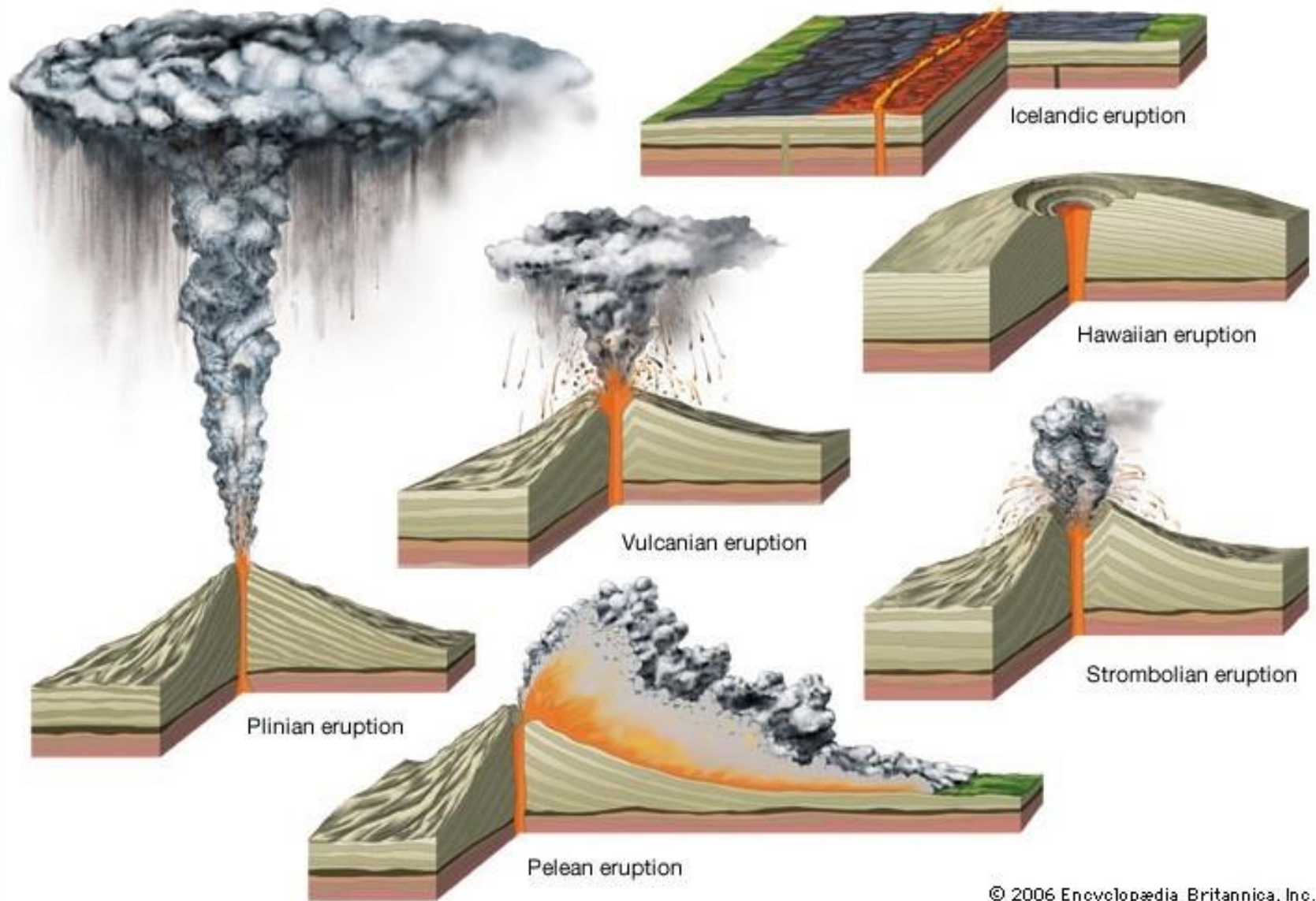
- In the 1980's scientists determined that there had been a massive volcanic eruption that affected the entire planet. It was dated to 1257 or 1258.
- In October of 2013, a scientific research group published the location and size of the eruption – it was the largest documented volcanic eruption in the previous 7000 years.
- In October of 2013, I discovered that Matthew Paris had recorded all the side effects of this eruption in his 13th century chronicle.
- This is that story in all of it's complexity.

Start with Volcanos

- Volcanoes leak molten rock from the interior of the earth to the surface.
- Sometimes the leak is slow – and new land is created.
- Sometimes the leak is fast – and there is lots of localized damage.
- Sometimes, volcanoes explode
 - Create empty spots on the surface (caldera)
 - Eject lots of material into the atmosphere
 - Can dramatically impact the local environment
 - Can dramatically impact the global environment

Plinian Eruption

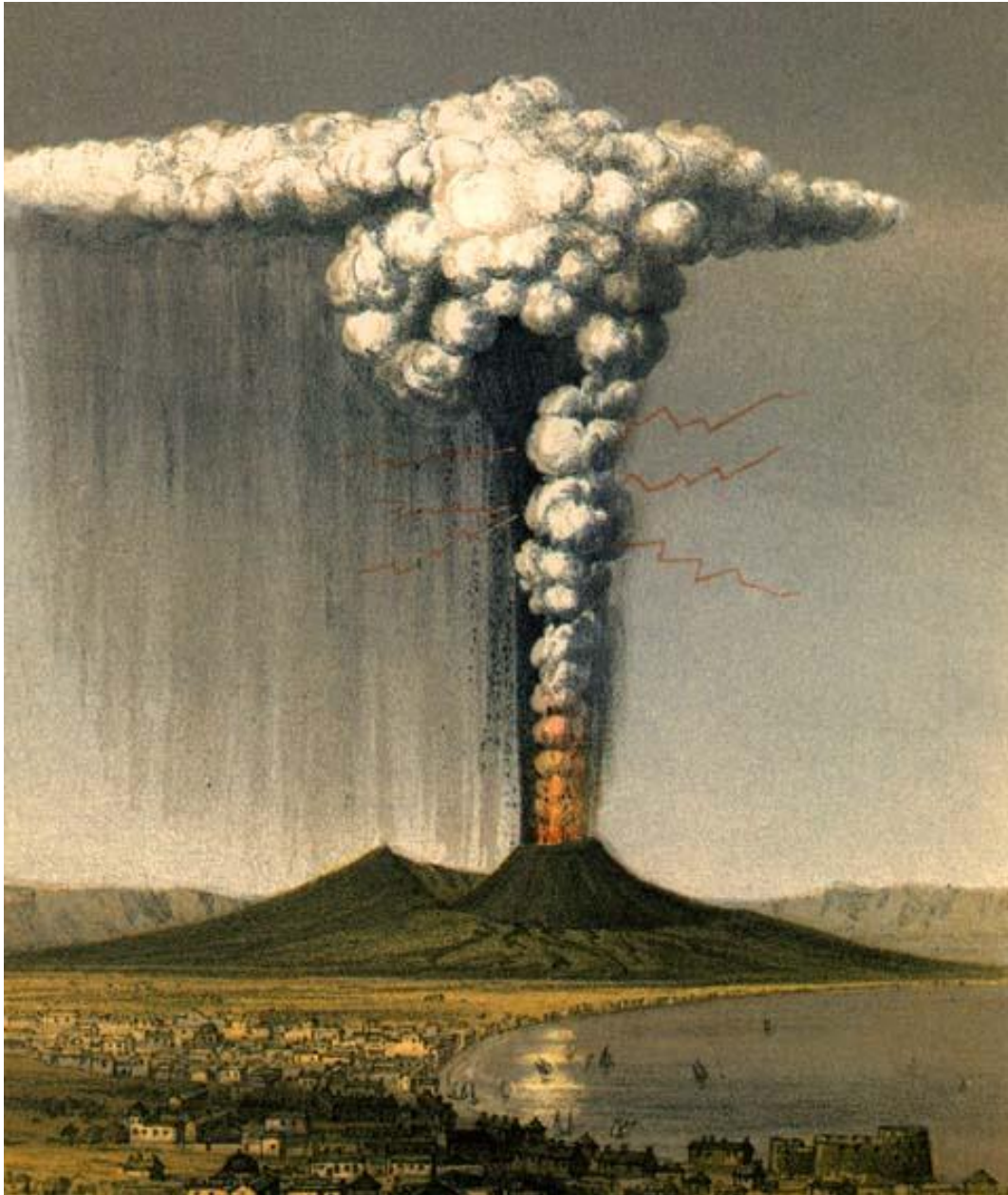
- Pliny the Younger documents the death of his uncle Pliny the Elder as the result of a volcanic eruption in AD 79.
- This is the volcano that everyone learns about in school: Mount Vesuvius in Italy (150 miles south of Rome)
- It is well documented and has a dramatic impact:
 - Pompeii and Herculaneum were buried by this explosion.
 - Anyone near was killed by the heat and deadly gas emitted by the explosion.
 - The ash and fallout preserved those cities and provides us with a very clear view of what life was like in AD 79.



Volcanic Eruption Types



A Stone Pine in Tuscany.
This is an example of the
type of tree used by Pliny
to describe the eruption.



1822 artist's impression of the eruption of Vesuvius, depicting what the AD 79 eruption may have looked like, by the English geologist George Julius Poulett Scrope



Mount St. Helens in Washington State experienced a Plinian eruption **following** a major flank collapse in 1980. Photo by Austin Post, USGS, May 18, 1980



8/19/2016

April 21, 1990 eruption cloud from Redoubt Volcano in the Aleutian Range in the state of Alaska (USA).



8/19/2016

Mt Pinatubo, Philippines, June 1991
(second largest in the 20th century)

11

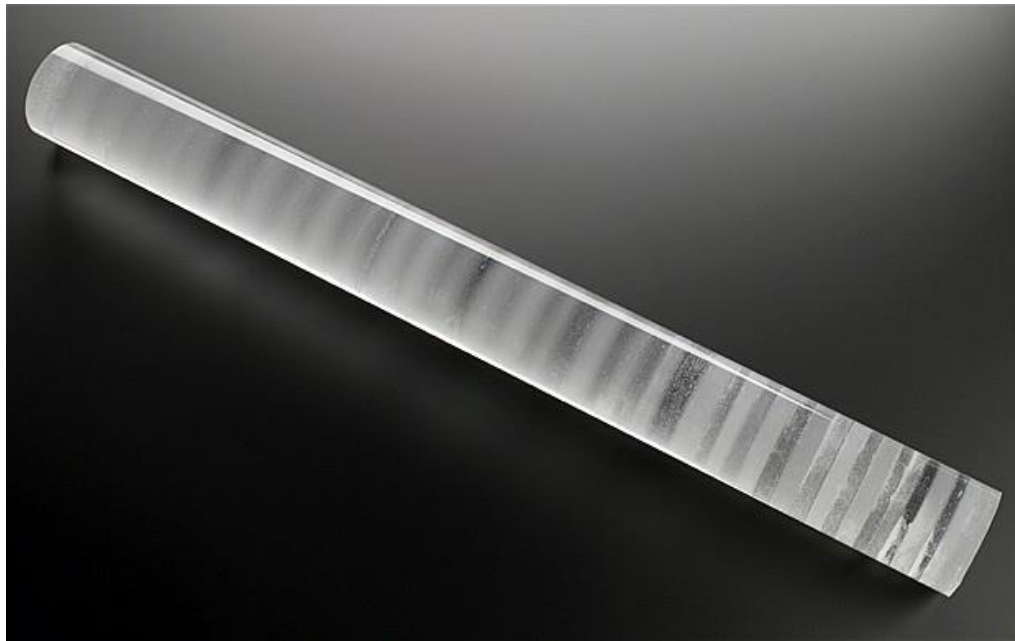
Specifics of Plinian Eruptions

- The hot gases and molten rock are released vertically under extremely high pressure.
- The vertical height can reach 60 KM or more – the stratosphere.
- The local devastation is dramatic as is the effect on global climate.

First: How do we find out about volcanic eruptions in the past?

First: How do we find out about volcanic eruptions in the past?

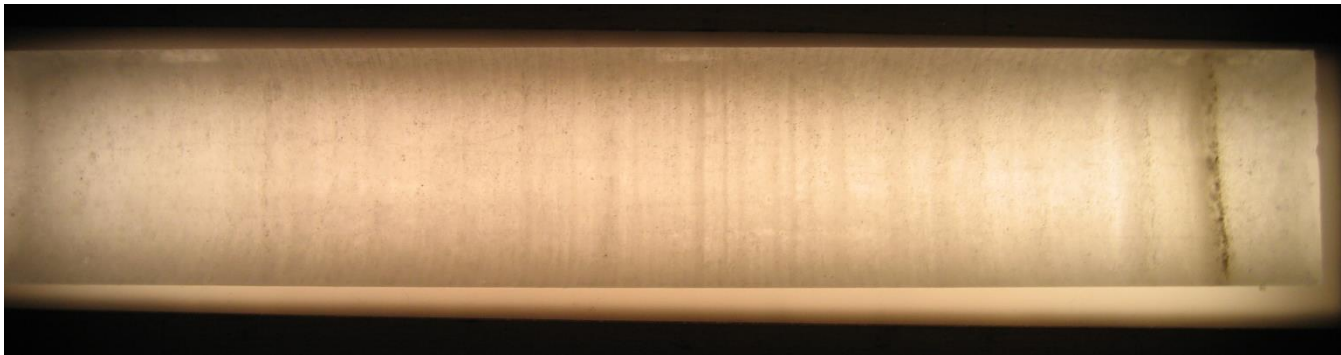
Ice Cores
Tree Rings



A block of ancient Antarctic ice, holding bubbles of air trapped 700 years ago.



Drilling ice cores in Antarctica



One of the most distinct ash layers in the Greenland ice cores is seen to the right of this 55 cm long piece of an ice core. It is the 55,500 year old ash layer Z2, which is believed to originate from an enormous eruption in Iceland.



<https://simpleclimate.wordpress.com/category/tree-rings/>

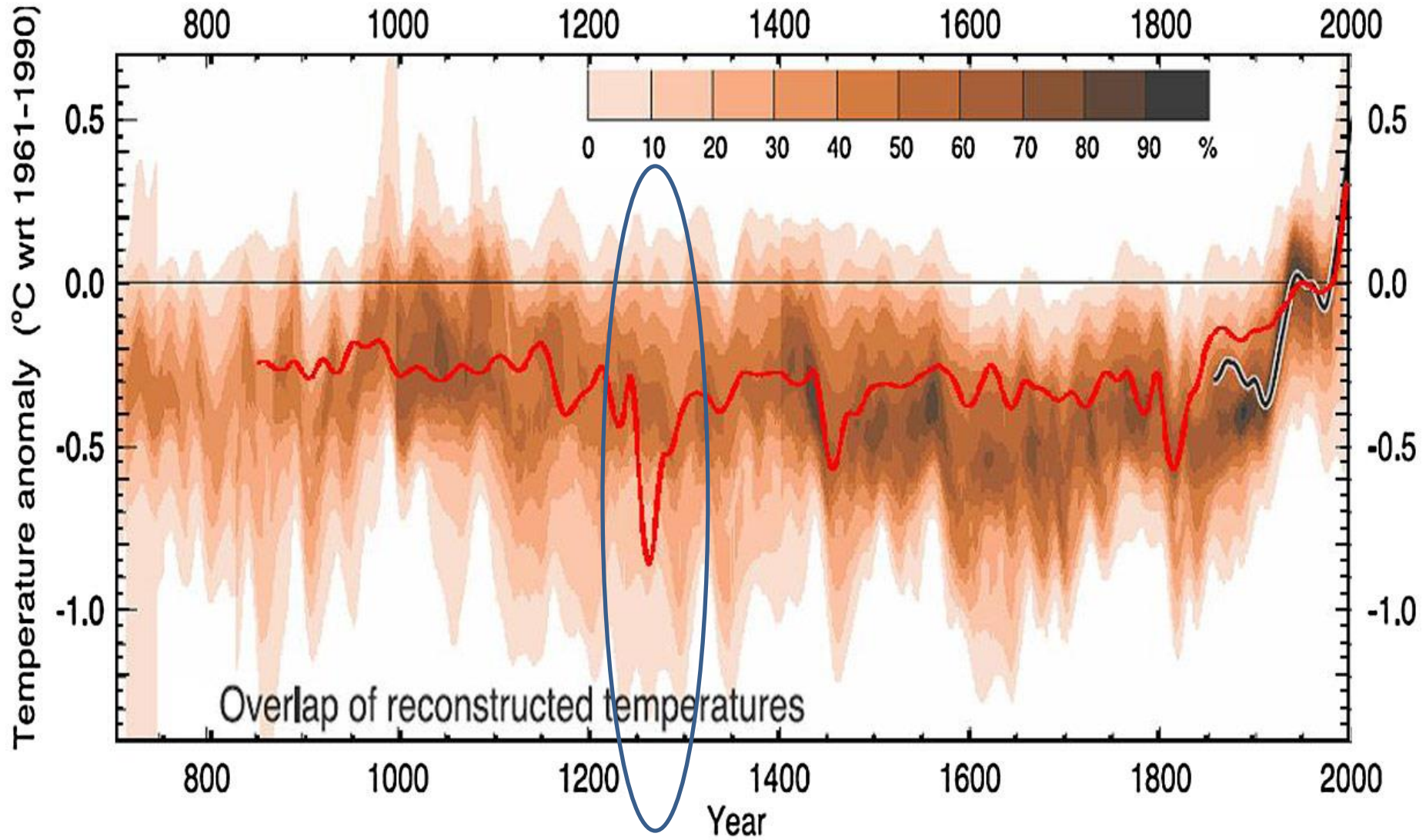


Tree-ring width sequence of a Cembran pine (*Pinus cembra*). A slightly delayed growth reduction follows the eruption of the Indonesian Tambora volcano in 1815, with narrow rings occurring after 1816.



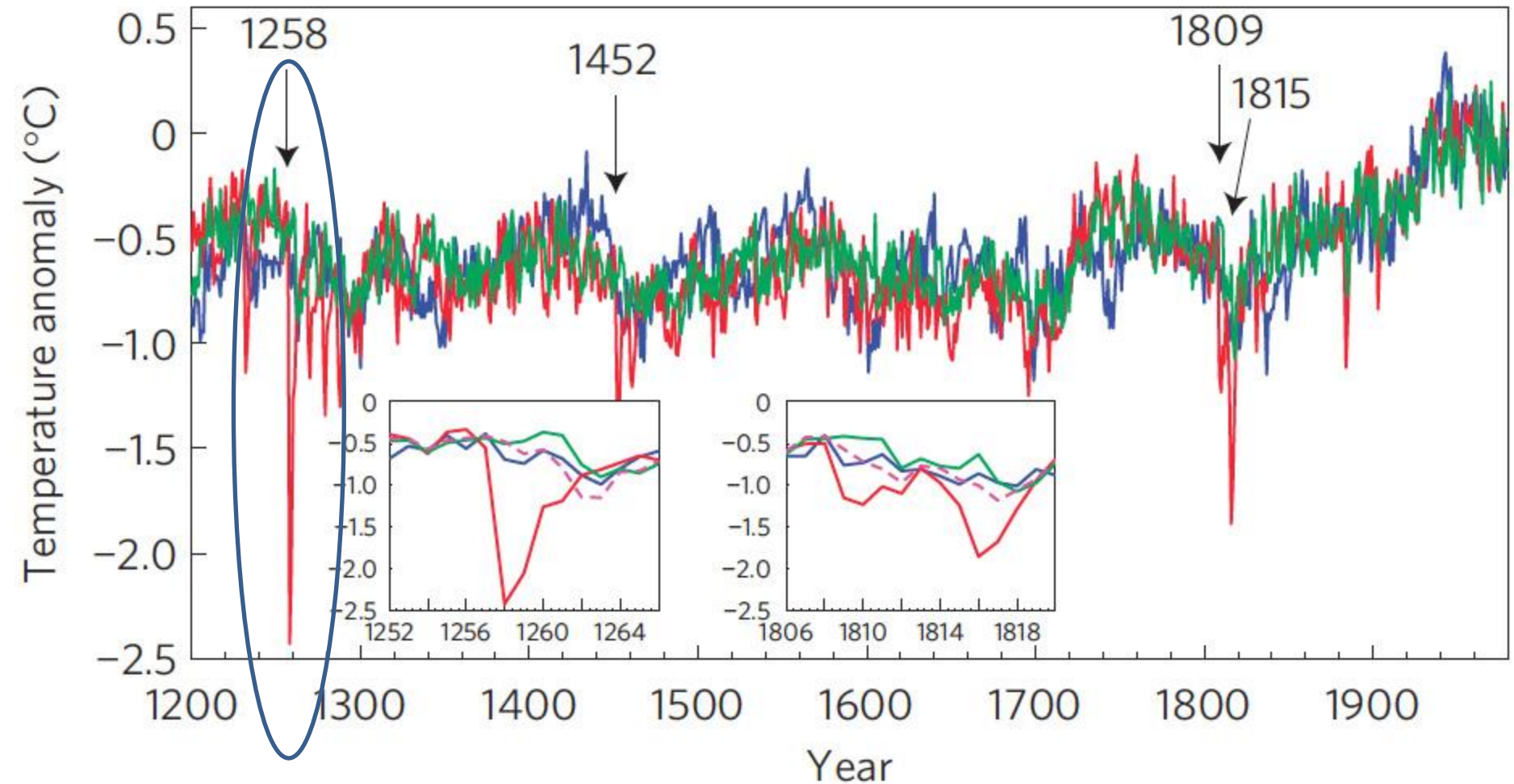
http://www.wsl.ch/medien/news/tree_ring_hochwasser_2013/index_EN

Reconstructed Global Temperature from Ice Core Data



Gao, C., A. Robock and C. Ammann. 2008: *Volcanic forcing of climate over the past 1500 years: An improved ice core-based index for climate models*. Journal of Geophysical Research-Atmospheres, 113, D23111 published in 2000

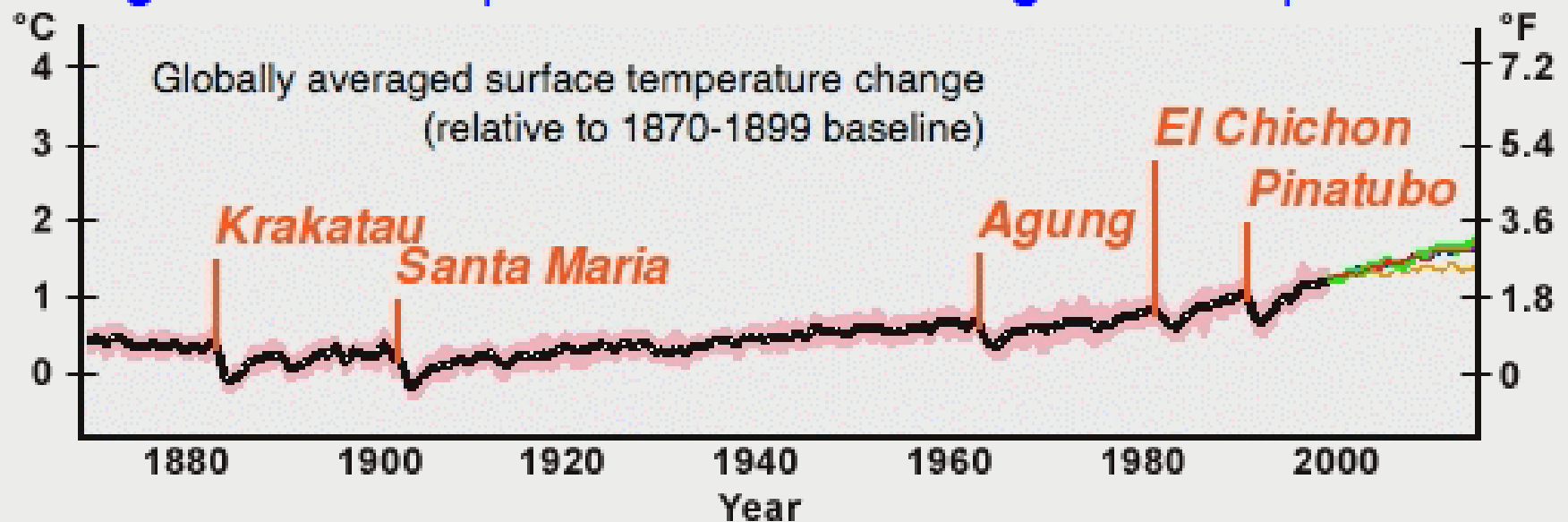
Global Temperatures from Tree Ring Data



What's going on here?

Some volcanic eruptions cool the entire planet.

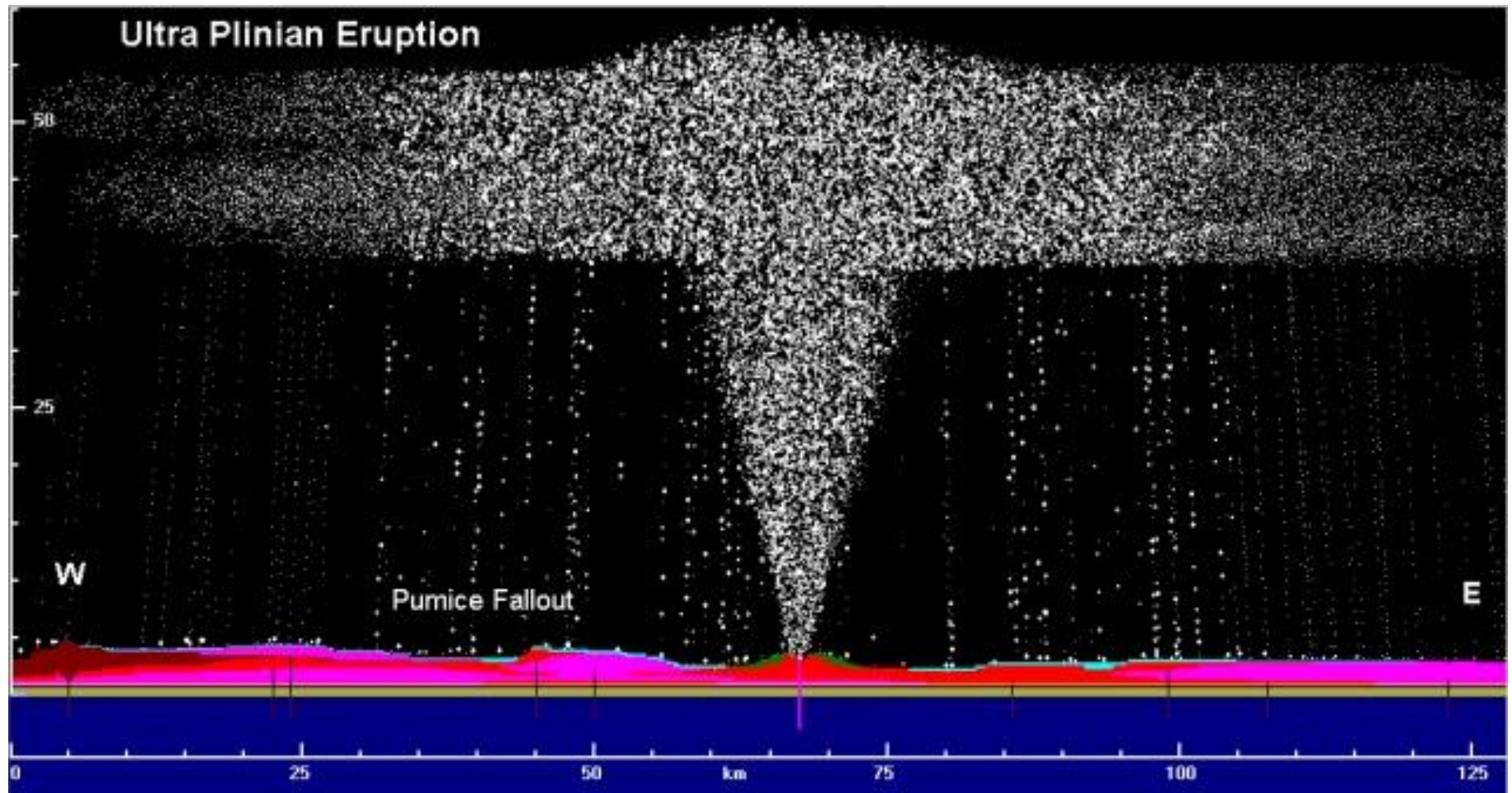
Big volcanic eruptions and effect on global temperature



Gary Strand (NCAR / DOE)

Stratosphere

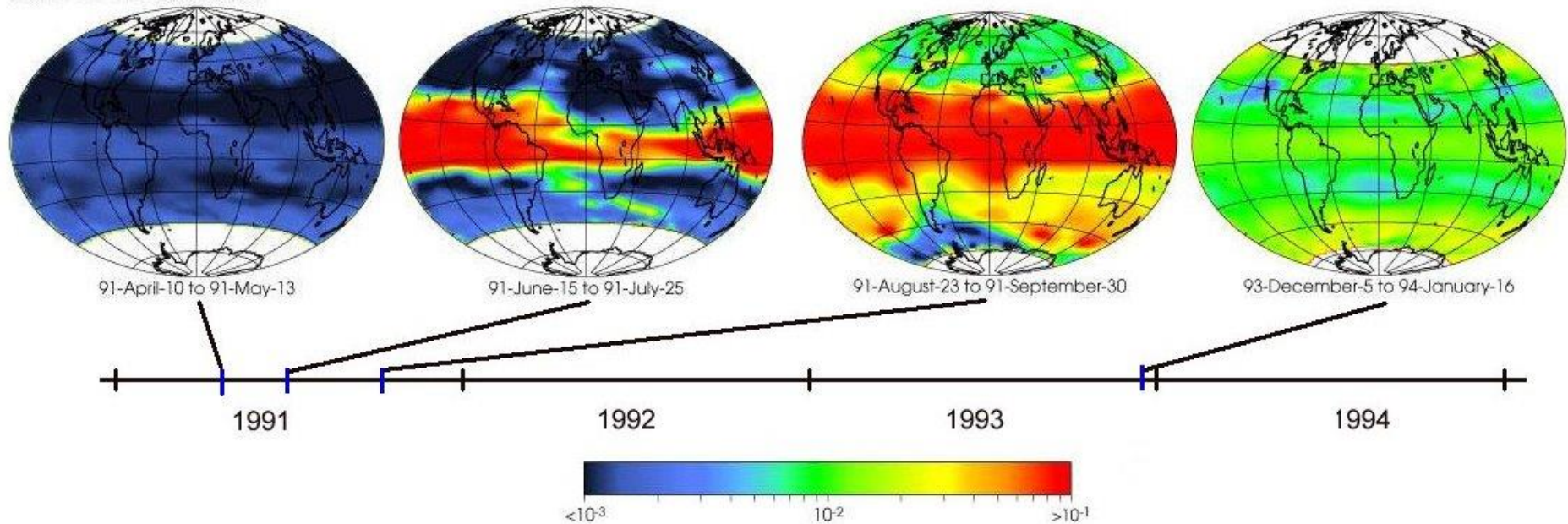
- The vertical part of any eruption dumps ash and sulphur into the atmosphere.
- The heavier stuff falls to the ground fairly quickly. Other material takes days or weeks or months.
- Plinian eruptions go straight up into the stratosphere – up to 50 KM (31 miles).
- Sulphites stay in the stratosphere for years and reduce sunlight.



Computer simulation of an ultra-plinian eruption in 600 A.D. that allegedly “started the dark ages”. This paper (published in 2000) says that global temperatures were lowered by five to ten degrees Celsius for up to ten years.

Mt Pinatubo, Philippines 15-July-1991

SAGE II 1020 nm Optical Depth



This chart shows the “optical depth” of the atmosphere as observed by the NASA SAGE II Satellite.

The images show before, immediately after, three months after and 30 months after the eruption of Pinatubo.

The blockage becomes world-wide very quickly and lasts for years.

Franck Lavigne

- In June of 2012 at a conference in Selfoss, Iceland, Frank Lavigne announced a teaser for his upcoming paper.
- He had determined the location and date of the “famous” 13th century volcanic eruption.
- His article was subsequently published in the October 15, 2013 issue of the Proceedings of the National Academy of Sciences.
- It was made available to the press on 30-Sep of the same year.

Source of the great A.D. 1257 mystery eruption unveiled, Samalas volcano, Rinjani Volcanic Complex, Indonesia

Franck Lavigne^{a,1}, Jean-Philippe Degeai^{a,b}, Jean-Christophe Komorowski^c, Sébastien Guillet^d, Vincent Robert^a, Pierre Lahitte^e, Clive Oppenheimer^f, Markus Stoffel^{d,g}, Céline M. Vidal^c, Surono^h, Indyo Pratomoⁱ, Patrick Wassmer^{a,j}, Irka Hajdas^k, Danang Sri Hadmoko^l, and Edouard de Belizal^a

^aUniversité Paris 1 Panthéon-Sorbonne, Département de Géographie, and Laboratoire de Géographie Physique, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 8591, 92195 Meudon, France; ^bUniversité Montpellier 3 Paul Valéry and Centre National de la Recherche Scientifique, Unité Mixte de Recherche 5140, 34970 Lattes, France; ^cInstitut de Physique du Globe, Equipe Géologie des Systèmes Volcaniques, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 7654, Sorbonne Paris-Cité, 75238 Paris Cedex 05, France; ^dInstitute of Geological Sciences, University of Bern, 3012 Bern, Switzerland; ^eDépartement des Sciences de la Terre (IDES), Université Paris-Sud, 91405 Orsay Cedex, France; ^fDepartment of Geography, University of Cambridge, Cambridge CB2 3EN, United Kingdom; ^gDepartment of Earth Sciences, Institute for Environmental Sciences, University of Geneva, 1227 Carouge, Switzerland; ^hCenter for Volcanology and Geological Hazard Mitigation, Geological Agency, 40122 Bandung, Indonesia; ⁱGeological Museum, Geological Agency, 40122 Bandung, Indonesia; ^jFaculté de Géographie et d'Aménagement, Université de Strasbourg, 67000 Strasbourg, France; ^kLaboratory of Ion Beam Physics, Eidgenössische Technische Hochschule, 8093 Zürich, Switzerland; and ^lFaculty of Geography, Department of Environmental Geography, Gadjah Mada University, Bulaksumur, 55281 Yogyakarta, Indonesia

Edited by Ikuo Kushiro, University of Tokyo, Tsukuba, Japan, and approved September 4, 2013 (received for review April 21, 2013)

Polar ice core records attest to a colossal volcanic eruption that took place ca. A.D. 1257 or 1258, most probably in the tropics. Estimates based on sulfate deposition in these records suggest that it yielded the largest volcanic sulfur release to the stratosphere of the past 7,000 y. Tree rings, medieval chronicles, and computational models corroborate the expected worldwide atmospheric and climatic effects of this eruption. However, until now there has been no convincing candidate for the mid-13th century "mystery eruption." Drawing upon compelling evidence from stratigraphic and geomorphic data, physical volcanology, radiocar-

northern hemisphere in A.D. 1258 (8–11). Medieval chronicles highlight an unseasonable cold summer with incessant rains, associated with devastating floods and poor harvests (10). The interhemispheric transport of tephra and sulfate suggests a low-latitude eruption (12, 13). Until now, however, identification of the volcano responsible for the medieval "year without summer" has remained uncertain, despite more than 30 y of investigations. Various candidates have been implicated, including Okataina (New Zealand), El Chichón (Mexico), and Quilotoa (Ecuador),

Table S1. The largest well-documented volcanic eruptions ($M > 5$) during the Holocene

Volcano	Country	Deposit name	Bulk deposit volume (km ³)	DRE volume (km ³)	Adjusted mass (kg)	Mass eruption rate (kg/s)	Maximum magnitude*	Intensity [†]	Age	Source
Kurile Lake	Kamchatka, Russia	KO	170	80	1.92×10^{14}		7.3		6460–6414 cal B.C.	(1)
Santorini	Greece	Minoan [‡]		60	1.48×10^{14}	2.50×10^8	7.2	11.4	1627–1600 cal B.C.	(2, 3)
Mazama (Crater Lake)	Oregon, United States	Lower pumice [‡]		52	1.28×10^{14}		7.1		5677 cal B.C.	(4, 5)
Samalas	Indonesia	1257 A.D. ^{‡ §}		>40	9.90×10^{13}	1.10×10^9	7.0	12.0	Cal A.D. 1257	Present work
Ilopango	El Salvador	Tierra Blanca Joven	84	39	8.15×10^{13}		6.9		Cal A.D. 536	(6, 7)
★ Tambora	Indonesia	A.D. 1815 [‡]		>33	8.15×10^{13}	2.8×10^8	6.9	11.4	A.D. 1815	(8, 9)
Taupo	New Zealand	A.D. 180	105	35	8.00×10^{13}	1.10×10^9	6.9	12.0	A.D. 232 ± 5	(8, 10, 11)
Aniakchak	Alaska, United States	3430 B.P.		27	6.21×10^{13}		6.8		1645 B.C.	(12–14)
Changbaishan/Baitoushan	China/North Korea	Millenium eruption	96	24.5	5.64×10^{13}		6.8		Cal A.D. 946	(15, 16)
Quilotoa	Ecuador	800 B.P.	21.3	18.7	4.22×10^{13}	2.00×10^8	6.6	11.3	Cal A.D. 1275	(17, 18)
Katmai - Novarupta	Alaska, United States	Valley of 10 000 Smokes	17	6.8	3.00×10^{13}	1.00×10^8	6.5	11.0	A.D. 1912	(8, 19)
★ Krakatau	Indonesia	A.D. 1883	18–21	12.5	3.00×10^{13}	5.00×10^7	6.5	10.7	A.D. 1883	(8, 20)
Santa Maria	Guatemala	A.D. 1902	20.2	8.6	2.00×10^{13}	1.70×10^8	6.3	11.2	A.D. 1902	(8, 21)
Quizapu	Chile	A.D. 1932 plinian	9.5	4	9.72×10^{12}	1.50×10^8	6.0	11.2	A.D. 1932	(22)



Samalas – Indonesia
(also Krakatoa and Tambora)

Major Points

- Mt Samalas, part of the Mount Rinjani Volcanic Complex on Lombok Island, Indonesia erupted in 1257.
- At least 40 cubic kilometers of ash ejected from the eruption (based on size of volcanic caldera)
 - Largest volume of ash expelled in the last 7000 years.
 - Eight times larger than Krakatoa (1883 – well recorded)
 - Twice the size of Tambora (1815 – the year without a summer – the summer that Mary Shelley wrote Frankenstein)
- Volcanic plume is calculated to have reached 43 km above the surface (size and range of ash fall)

Minor Points

- Happened between May and October of 1257 (prevailing seasonal winds and the depth of nearby ash deposits)
- Ash fall on the island was 25m deep even as far away as 25km.
- Eruption appeared to have lasted seven days.
 - There were two large vertical explosions, separated by a more horizontal one, followed by days of ash falling down.

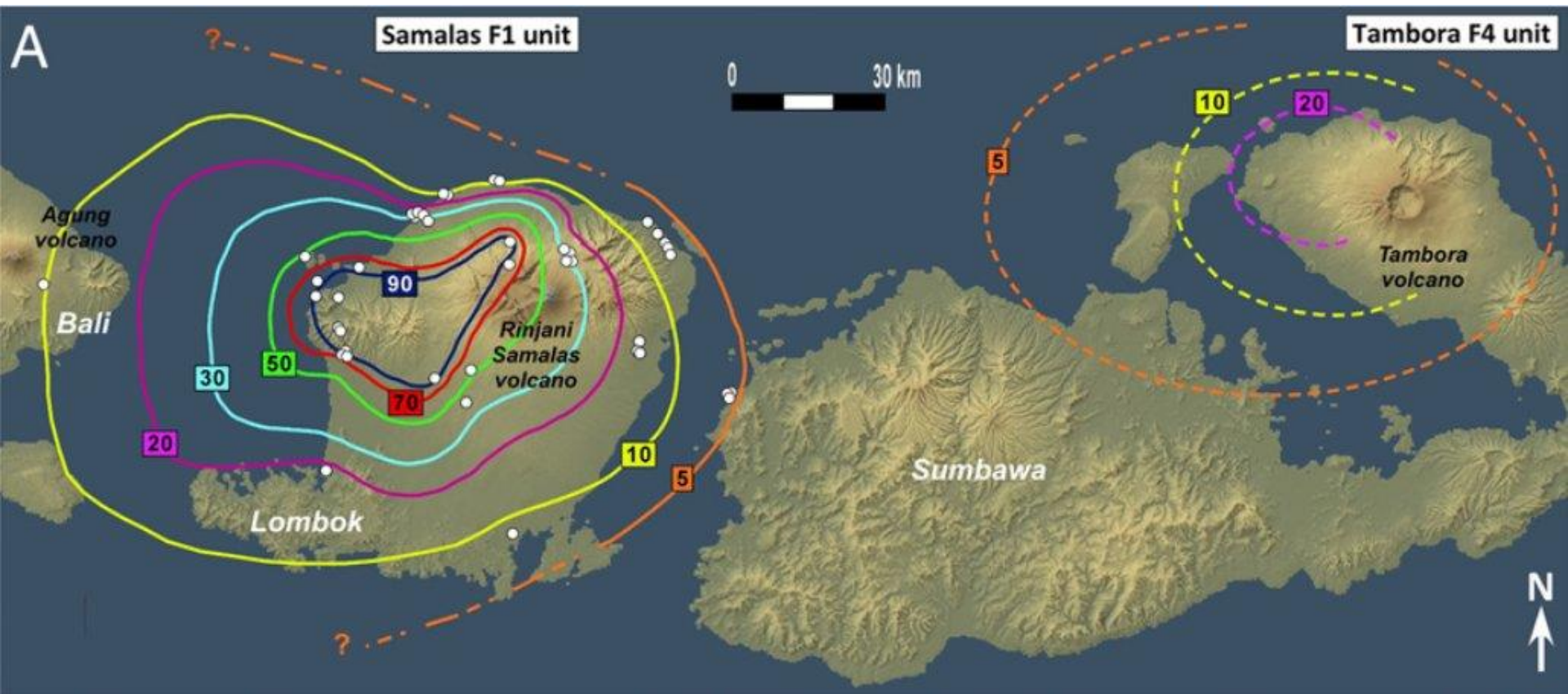
Historical Records quoted by Lavigne

- Babad Lombok – an Indonesian Poem
 - Gives the name of the (now missing) mountain.
 - All that remains today is nearby Mt. Rinjani.
 - Destroyed the capital city of Pamatan
- Two French Chronicles describe an unusually warm winter in fall of 1257 thru early 1258.
- Matthew Paris (England) records hot humid weather in the fall/winter of 1257 and a rainy cool wet summer the following year.

Significance

Based on ice core archives of sulfate and tephra deposition, one of the largest volcanic eruptions of the historic period and of the past 7,000 y occurred in A.D. 1257. However the source of this “mystery eruption” remained unknown. Drawing on a robust body of new evidence from radiocarbon dates, tephra geochemistry, stratigraphic data, a medieval chronicle, this study argues that the source of this eruption is Samalas volcano, part of the Mount Rinjani Volcanic Complex on Lombok Island, Indonesia. These results solve a conundrum that has puzzled glaciologists, volcanologists, and climatologists for more than three decades. In addition, the identification of this volcano gives rise to the existence of a forgotten Pompeii in the Far East







“On the northwest coast, a remnant of the ignimbrite at 23 km from the caldera rim forms a 35-m-high recessive cliff (D), suggesting that a substantial part of the PDCs entered the sea.” (PDC = Pyroclastic density current (PDC))

Climate Science

- Tropical eruptions generate globe-girdling stratospheric aerosol veils (dry fogs) that persist for several years, slowly settling out.
- Aerosols block some of the incoming sunlight.
- This results in a cooler surface temperature.

<http://www.ncdc.noaa.gov/teleconnections/nao.php>

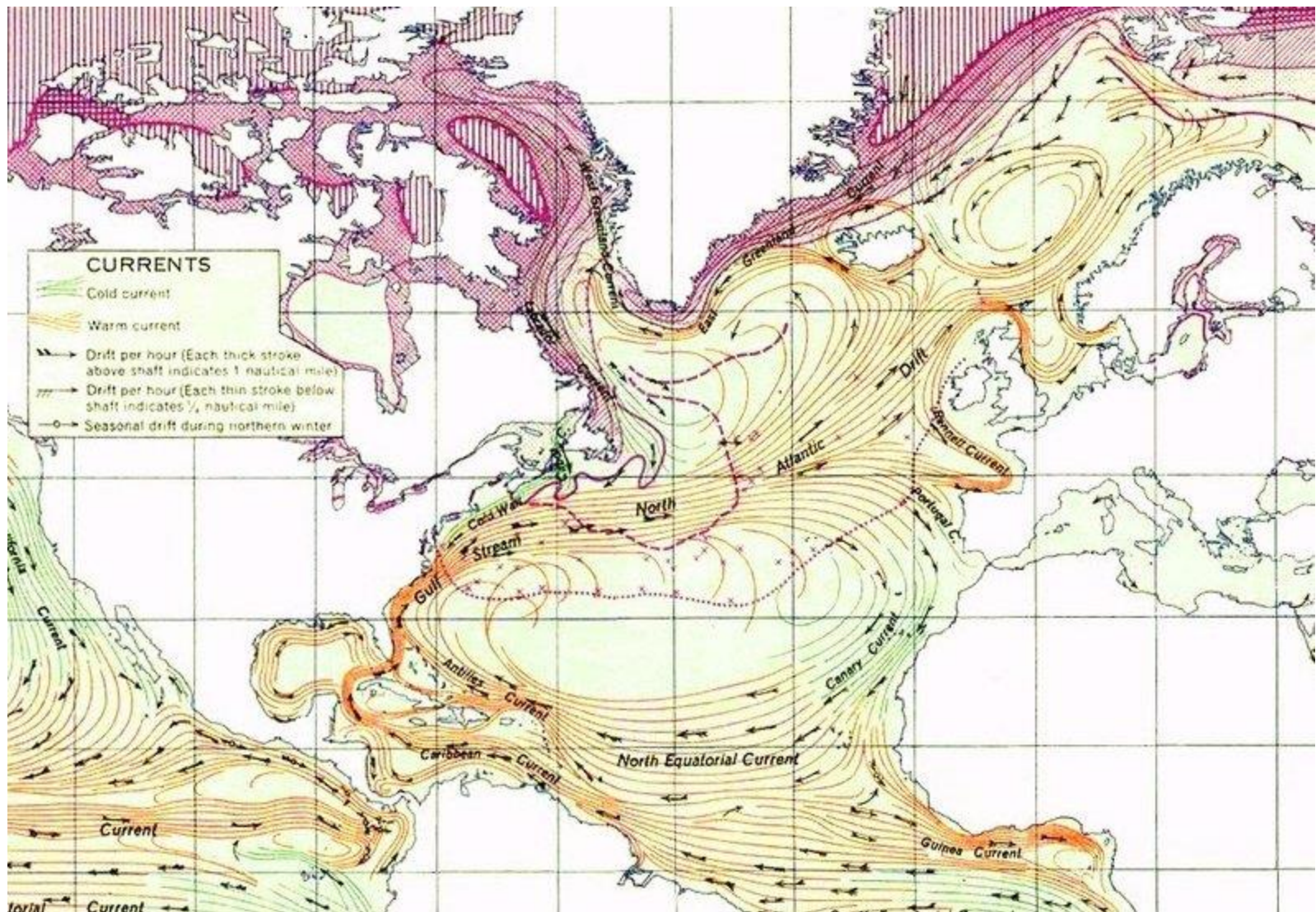
Cooling

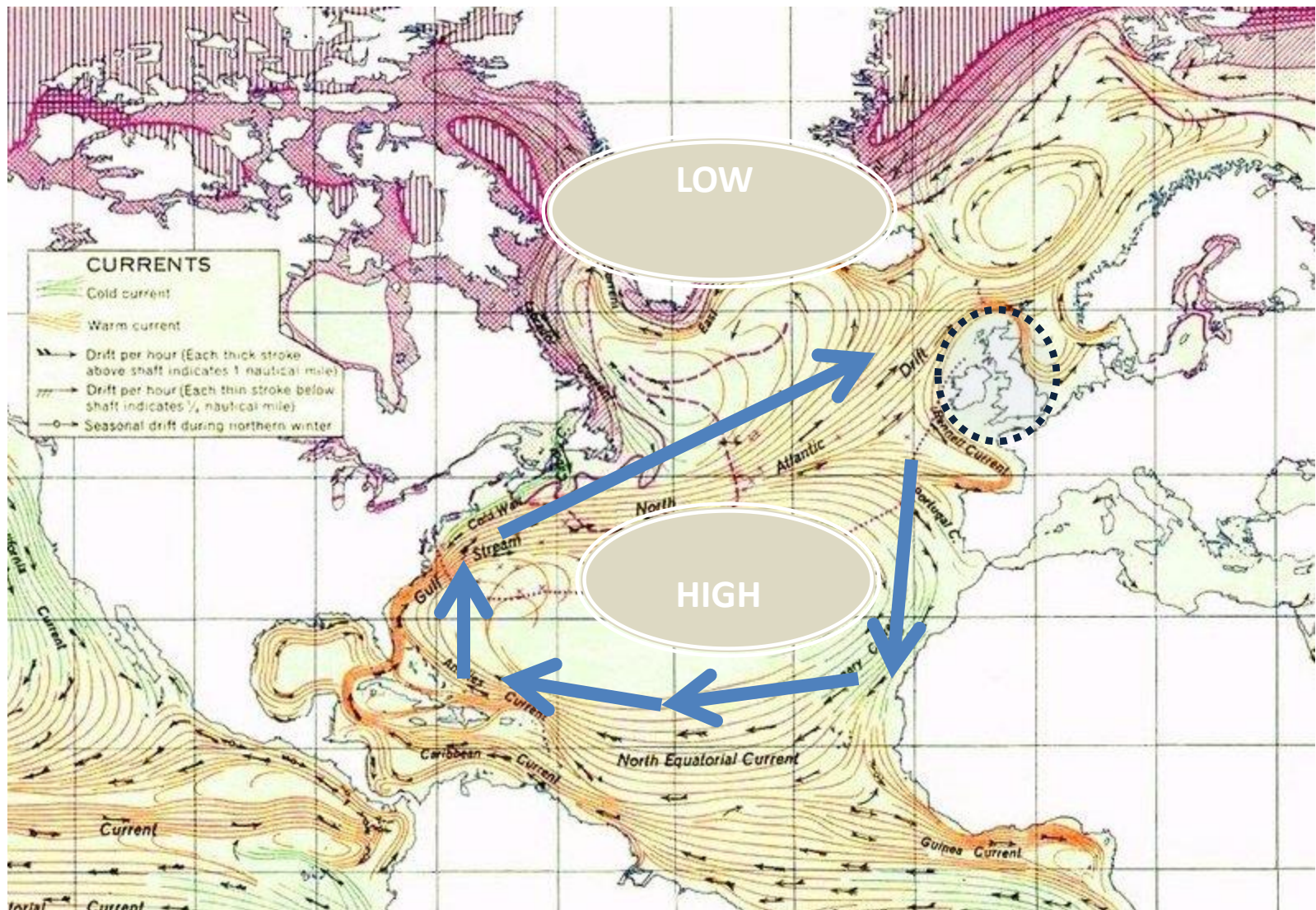
- Recent eruptions : 0.2 Celcius.
- In 1883, Krakatau : half a degree Celcius.
- In 1815, Tambora : 2 degrees Celsius.
- In 1257, Samalas : 4 degrees Celsius.
- In 600, Krakatau : 5-10 degrees Celcius
- Approx 77K years ago, Toba :
Six year volcanic winter. Climate side effects lasting 1000 years.
Evidence is that there was a huge negative impact on genetic diversity at about that time.

North Atlantic Oscillation (NAO)

- Fluctuations in climate controlled by a High Pressure “node” off Africa and a Low Pressure Node above Iceland and Greenland.
 - The two spots direct weather flow around the Atlantic Ocean with a particular funnel into England and Northern Europe.
- Research shows that a cooling (like from a volcanic eruption) results in a “negative” NAO.
- This brings below-normal temperatures into the eastern United States and across northern Europe.
- This brings above-normal temperatures in Greenland and oftentimes across southern Europe and the Middle East.
- The reverse is true as well.

<http://www.ncdc.noaa.gov/teleconnections/nao.php>





Erich Fischer

- Studies climate events.
- Did his Ph.D. (2010) on how volcanic eruptions are an important natural cause of climate variations.
- Published various papers describing seasonal variations and extremes of climate.
- Key paper in 2007 specifically studied European climate response to specific tropical volcanic eruptions over the last 500 years using various signals (like tree rings, ice core deposits, etc).



European climate response to tropical volcanic eruptions over the last half millennium

E. M. Fischer,^{1,2} J. Luterbacher,¹ E. Zorita,³ S. F. B. Tett,⁴ C. Casty,⁵ and H. Wanner¹

Received 30 August 2006; revised 23 December 2006; accepted 23 January 2007; published 6 March 2007.

[1] We analyse the winter and summer climatic signal following 15 major tropical volcanic eruptions over the last half millennium based on multi-proxy reconstructions for Europe. During the first and second post-eruption years we find significant continental scale summer cooling and somewhat drier conditions over Central Europe. In the Northern Hemispheric winter the volcanic forcing induces an atmospheric circulation response that significantly follows a positive NAO state connected with a significant overall warm anomaly and wetter conditions over Northern Europe. Our findings compare well with GCM studies as well as observational studies, which mainly cover the substantially shorter instrumental period and thus include a limited set of major eruptions. **Citation:** Fischer, E. M., J. Luterbacher, E. Zorita, S. F. B. Tett, C. Casty, and H. Wanner (2007), European climate response to tropical volcanic eruptions over the last half millennium, *Geophys. Res. Lett.*, 34, L05707, doi:10.1029/2006GL027992.

eruptions may even represent a substantial climate forcing over decadal to multi-centennial timescales [e.g., Crowley, 2000].

[3] Analysis of observational data indicate that over higher latitudes of Northern Hemispheric (NH) land regions radiative cooling following eruptions is dominant only in the summer half-year, whereas anomalously warm conditions prevail during boreal winters [Groisman, 1992; Robock and Mao, 1992; Kelly et al., 1996; Shindell et al., 2004]. GCM studies suggest that the winter warming is produced by atmosphere-dynamical effects in form of a positive phase of the Arctic Oscillation/North Atlantic Oscillation (AO/NAO) [e.g., Graf et al., 1994; Shindell et al., 2001; Stenchikov et al., 2002, 2006]. The positive phase of the AO/NAO is induced by an enhancement of the stratospheric meridional temperature gradient caused by radiative heating in the aerosol cloud over the tropics [Kodera, 1994; Kirchner et al., 1999]. Stenchikov et al.

Climate Science (by Fisher)

For tropical volcanic eruptions:

- The first two winters in Europe are warmer.
- The first summer in Europe is cooler.
- Effects last less than three years.
- Aerosols and moisture ejected into the tropical air circulation pattern change the weather patterns causing warmer air to circulate in the northern hemisphere during the winter months.
- Those same aerosols block the sunlight – thus in the summer, radiative cooling in the northern hemisphere in summer months causes substantial cooling.

3 2044 127 244 200



A bioarchaeological study of medieval burials on the site of St Mary Spital

Excavations at Spitalfields Market, London E1, 1991–2007

Brian Connell, Amy Gray Jones, Rebecca Redfern and Don Walker



ARCHAEOLOGY

MONOGRAPH 60

Museum of London Archeology

- In southern London, there was an Augustine priory and hospital: St Mary Spital.
- Excavations in 1991-2007 in Spitalfields Market, London revealed 10,500 bodies dated 12th-16th Century from the burial grounds at that priory and hospital.
- This is just one hospital out of hundreds built in the 12th century in and around London.

Museum of London Archeology

- Approximately 4000 of the bodies exhumed could be radio-carbon dated to a period around the 1258 disaster.
- First assumed it was the Black Death of 1348-1350, but tests showed it was much earlier.
- Normal burials replaced by multiple burials.
 - Normally one or two people in a grave.
 - Four to eight per grave in 1258 period.
 - Ten to twenty per grave in 1358-1350.

The Medieval Agricultural Year
By Rachel Hartman, 12 February 2001
<http://strangehorizons.com/2001/20010212/agriculture.shtml>

Four grains were widely cultivated during the Middle Ages: wheat, barley, rye, and oats.

- All four sown in fall (Sept/Oct) for harvest the following summer. (so-called winter crop which is susceptible to bad weather).
- Farmers would plant a second “spare” crop in the spring (generally March), and to be harvested in early fall. (so called spring crop – smaller, shorter growing period)

Daily Life in Medieval Europe

By Jeffrey L. Forgeng pp 94-97

- Peasant year begins Sept 30 (Michaelmas)
- The Autumn (July, Aug, Sep) was harvest time (hay, then grains/straw).
- Michaelmas to Christmas was “winter”
- Had to plant winter crops as soon as possible (wheat, cabbage, some others).
 - Spring is Rye, Barley, and legumes.
 - Summer is tending the fields.
- Wet weather is disaster in Autumn, because wet hay and wet grains and wet straw are useless.

OK – What do we know?

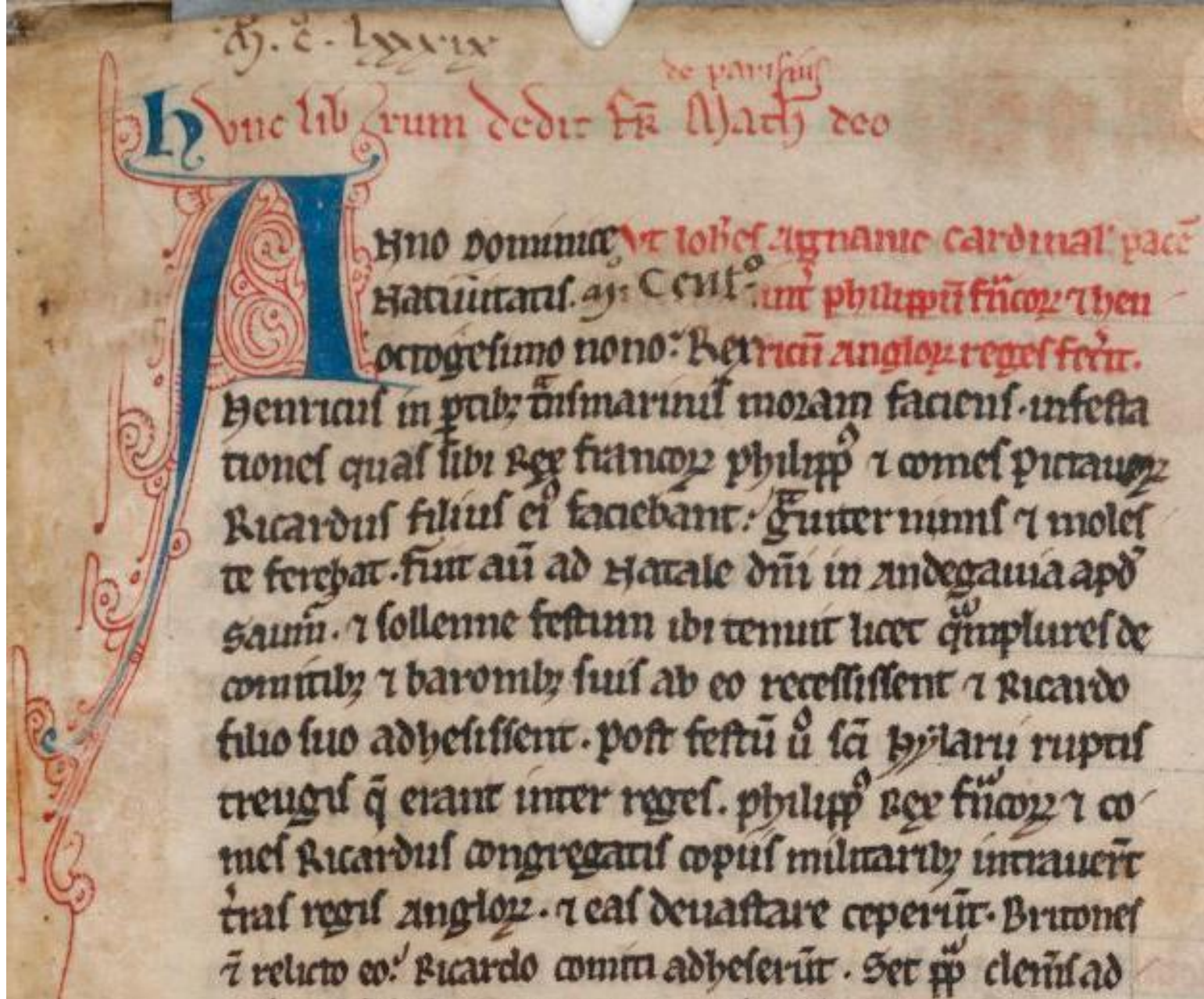
- There was a major volcanic eruption in 1257.
- Dry-fog, ash, glass dust fall from the sky around the entire globe.
- Sulphur compounds block sunlight.
 - Winters are warmer, Summers are cooler.
 - Tons more rain.
 - Effects happen relatively quickly and last a couple of years.
- Crops and seasonal plantings very susceptible to bad weather.

Can we see this in period?

Matthew Paris

(aka Matthæus Parisiensis)

- Lived his life at the Abbey of St. Albans (just north of London)
- Entered the monastery in 1217 A.D.
 - (presumably at the age of 17)
 - Died in 1259 A.D.
- His life roughly coincides with that of King Henry III (1207 – 1272 A.D.)
- Prolific chronicler, scribe, artist.



The first page of the *Chronica Majora* written by Matthew Paris

Format of Chronicle

- Each year is clearly marked in his chronicle.
- Each year includes many entries – pages of notes on events of the day.
- Each year ends with a summary usually includes a quick description of the weather for the year (as it relates to crops).
- Most other weather notes are random horrible storms.
- For 1257-1259 it's much different.
- The translation is A.J. Giles from 1889.

Notes on Dates

- Each year starts with where the King celebrates Christmas. Nominally, the year starts at the end of October and runs through September.
- These are the reign years of Henry based on the date of his Coronation.
- Notes appear to be written into the chronicle months later – sometimes dates and events are not presented correctly.

1253 – This year throughout was abundant in corn and fruit; so much so that the price of a measure of corn fell to thirty pence.

1254 – This year throughout was abundantly productive in fruit and corn, so that the price of a measure of corn fell to two shillings; and like proportion oats, and all other kinds of corn and pulse fell in price to the benefit of the poor plebeians.

1255 – [This year] was throughout so productive in corn and fruit, that a measure of wheat fell in price to two shillings and the same quantity of oats to twelvecence.

1256 ... (on 10 Aug), an extraordinary storm, or succession of storms of wind and rain, accompanied by hail, thunder, and lightning, alarmed men's heads, and caused irreparable damage. One might see the wheels of mills torn from their axles and carried by the violence of the wind to great distances, destroying in their course the neighbouring houses; and what the water did to the water-mills, the wind did not fail to do to the wind-mills. Piles of bridges, stacks of hay, the huts of fisherman with their nets and poles, and even children in their cradles, were suddenly carried away, so that the deluge of Deucalion seemed to be renewed. Not to mention other places, Bedford, which is watered by the Ouse, suffered incomputable damages, as it had done a few years before. Indeed, in one place, six houses immediately adjoining each other were carried away by the rapidity of the torrents, their inhabitants having much difficulty in saving themselves; and other places contiguous to that river were exposed to similar perils.

1256 – Then closed this year, which had been tolerably productive of fruit and corn. ... It was beyond measure stormy and rainy, so that, indeed, the times of Deucalion seemed to be renewed. From the day of the Assumption of the Blessed Virgin (Aug 15) to the anniversary of her Purification (Feb 2), the rain ceased not to fall daily in deluges, which rendered the roads impassable and the fields barren. Hence at the end of autumn, the corn was rotted in the ear.

Greek Mythology: Deucalion

[An angered] Zeus unleashed a deluge, so that the rivers ran in torrents and the sea flooded the coastal plain, engulfed the foothills with spray, and washed everything clean.

Deucalion, with the aid of his father Prometheus, was saved from this deluge by building a chest.

1257 – Of the extraordinary fall of rain, and the thunder during the winter. On the Innocents' Day (28 Dec 1256 or else July 28 in 1257) in this year such a quantity of rain fell that it covered the surface of the ground, and the times of Deucalion seemed to be renewed. The furrows looked like caves or rivers, and the rivers covered the meadows and all the neighbouring country, so that it presented the appearance of a sea. That from one case other similar ones may be understood, I may mention, that one river alone in the northern parts of England carried away seven large bridges of wood and stone, the mills, too, and the neighbouring houses, were carried away by the violence of the torrent-swollen streams and destroyed.

On the aforesaid day, too, a fierce whirlwind, accompanied by a violent hail-storm, disturbed the atmosphere and obscured the sky with darkness like that of night. The clouds collected together, and from them the lightning darted forth with fearful vividness, followed by claps of thunder. This thunder was clearly a bad omen, for it was mid-winter, and the cold was equal to that generally felt in February. This weather was followed by sickly unseasonable weather, which lasted about three months.

1257 - The Summary of the Year - This year was throughout barren and meagre; for whatever had been sown in winter had budded in spring, and grown ripe in summer, was stifled and destroyed by the autumnal inundations. The scarcity of money, brought on by the spoilation practiced by the king and the pope in England brought unusual poverty. The land lay uncultivated, and great numbers of people died from starvation. About Christmas, the price of a measure of wheat rose to ten shillings. Apples were scarce, pears more so, figs, beechnuts, cherries, plums - in short, all fruits which are preserved in jars were completely spoiled..

This pestiferous year, moreover, gave rise to mortal fevers, which raged to such an extent that, not to mention other cases, at St Edmund's alone, more than two thousand dead bodies were placed in the large cemetery during the summer, the largest portion of them during the dog-days. There were old men, who had formerly seen a measure of wheat sold for a mark, and even twenty shillings without the people being starved to death. ... This year too generated chronic complaints, which scarcely allowed free power of breathing to anyone labouring under them. Not a single fine or frosty day occurred, nor was the surface of the lakes at all hardened by the frost as was usual; neither did icicles hang from the ledges of houses; but uninterrupted heavy falls of rain and mist obscured the sky until the Purification of the Blessed Virgin Mary.

1258 – Of the arrival in England of some ships laden with wheat. At this same time, too, whilst an extraordinary famine was prevailing to such a degree that numbers pined away in themselves and died, a measure of corn being sold at London for nine shillings or more, about fifty large ships arrived there from the continent, having been sent by Richard, king of Germany, laden with corn, wheat, and bread. ... It was stated as positive fact, that any three counties of England united had not produced so much corn as was brought by these vessels.

1258 - Of the remarkable nature of the season. In this same year, the calm temperature of autumn lasted to the end of January, so that the surface of the water was not frozen in any place during that time. But from about that time, that is to say, from the Purification of the Blessed Virgin till the end of March, the north wind blew without intermission, a continued frost prevailed, accompanied by snow and such unendurable cold, that it bound up the face of the earth, sorely afflicted the poor, suspended all cultivation, and killed the young of the cattle to such an extent that it seemed as if a general plague was raging amongst the sheep and lambs.

1258 - Of the great famine which prevailed throughout the whole of England. About the feast of the Trinity in this year, an awful and intolerable pestilence attacked the people, especially those of the lower orders, and spread death among them in a most lamentable degree. In the city of London, fifteen thousand of the poor had already perished. ... In fact famine prevailed in England to such great extent, that many thousand human beings died of hunger; for the crops only arrived at maturity so late in the autumn, in consequence of the heavy rains, that the harvest was only got in by All Saints' day in several parts of the kingdom, and a measure of corn was sold for sixteen shillings.

1258 - Of the mortality caused by the famine amongst the people. About the same time, such great famine and mortality prevailed in the country, that a measure of wheat rose in price to fifteen shillings and more, ... and numberless dead bodies were lying about the streets. ... Unless corn had been brought for sale from the continent, the rich would scarcely have been able to escape death. ... the dead lay about, swollen up and there was scarcely any one to bury them; nor did the citizens dare or choose to receive the dead into their houses, for fear of contagion. ... if corn could have been sold for a small price per measure, scarcely any one could have been found with the means of buying it.

... At this time, too, that is, at the end of July and beginning of August, ... such misery, want and famine prevailed, that those who usually aided others were now amongst the unfortunates who perished from want. What alarmed the lower orders more than the nobles, was the continued heavy falls of rain, which threatened destruction to the rich crops which God had given hopes of previously. To sum up briefly, England would have failed in herself, had she not been restored to life by the arrival of some vessels, belonging to traders on the continent, which were laden with corn and bread for sale, brought from Germany and Holland; still many who spent all their money, died of hunger and want.

At the feast of the Assumption of the Blessed Virgin (Aug 15), when generally the barns are filled with the yearly crops of corn, scarcely even a shingle sheaf was ripe; and as the rain increased daily, the hired labourers and their cattle caused a great expense daily, without being able to leave their houses or to do any good in the fields. In consequence, a circumstance hitherto unknown, at the feast of All Saints, the corn was standing about the country ready to be cut down, but useless and spoiled almost. In some places, indeed, although late and the crop of little use, it was cut and carried, whilst in many others it was left altogether in the fields to be used as manure to enrich the soil. It should be known also, that in that year the land produced such an abundant crop, that, had it all been saved, it would have been sufficient for nearly two years' consumption.

1258 - Of the general disposition of events during the whole year. This year throughout was very dissimilar to all previous ones, bringing disease and death, and heavy storms of wind and rain. Although in the summer-time a fair promise of abundant crops of corn and fruit was given, yet in the autumn the continual heavy rains spoiled the corn, fruit and all kinds of pulse; and at the Advent of our Lord, in some parts of England, as above stated, the barns remained empty, and the crops remained ready to be cut, but entirely spoiled: for as the corn shot up, the ear and the straw rotted together, and as men died from the want of corn, so the cattle died from the want of fodder; and though England was drained of money on many pretexts, yet the people were obliged, at the instigation of hunger, to pay sixteen shillings for a measure of corn, whilst still moist and shooting; and consequently the poor pined away with hunger, and died.

The dying staggered away into different by-places to yield their last wretched breath; and of these there was such a great number, that the gravediggers were overcome with weariness and threw several bodies into one grave. The people of the middle class, seeing their food failing them, sold their flocks, diminished the number of their household, and left their land uncultivated, whereby all hope of rising from this abyss, which hope generally consoles those despairing, was entirely extinguished. Had not corn been brought for sale from the continent, there is no doubt but England would have perished in herself.

In the same [year], when the sun was in Cancer (late June thru July), an unexpected pestilence and mortality fell upon mankind; and to say nothing of the great numbers that died in other places, in Paris alone, more than a thousand human beings were consigned to the tomb. Oil, wine, and corn also were spoiled. As the two-handed sword of death, which spares no-one, strikes sometimes one and sometimes another, and hurries from the world the rich and the poor alike, so Fulk, bishop of London, died during that deadly pestilence...

- Matthew dies in 1259.
- The chronicler that follows him writes little.
- There is the implied assumption that by 1260 everything was back to normal from what I can find.
- Most chronicles that do mention this disaster only briefly mention the price of corn in 1258.
- Matthew's chronicle is the only one (so far) that provides so much detail.

Famous Volcanoes

2010 Eyjafjallajökull, Iceland (VEI: 4)

Caused havoc to air traffic in Europe because the Jet Stream was right over the eruption and carried ash all over Europe.

1991 Mt Pinatubo, Philippines (VEI: 6)

Decreased planetary sunlight by 10% for three years

1980 Mt St. Helens, USA (VEI: 5)

Interstate 90 from Seattle to Spokane was closed for a week and a half due to ash fall and reduced visibility.

1883 Krakatoa, Indonesia (VEI: 6)

Tidal waves felt as far away as London.

1815 Mt Tambora, Indonesia (VEI: 7)

The year without a summer.

1257 Mt Samalas, Indonesia (VEI: 7)

The largest explosion in 7000 years.

79 Mt Vesuvius, Italy (VEI: 5?)

Buried Pompeii and Herculaneum. – described by Pliny the Elder

Anecdotes

- Mt. Tambora (1815) is the cause of Mary Shelley's story called "Frankenstein". The weather forced the summer party indoors – where Lord Byron proposed they "each write a ghost story". This is the famous "Year Without A Summer" (1816).
- Mt Samalas (1257) The first recorded incident of the Flagellant Movement was in Perugia, Italy in 1259. This is the year after severe crop damage and famine and civil unrest throughout Europe. It dies out and comes back for the Black Plague in the 14th Century.
- Toba (70K years ago) "Toba Hypothesis" explains narrowing of variability in the mitochondrial DNA which shows a small population of human ancestors survived the volcanic winter (10-15K people).