"Eighteen Hundred and Froze to Death": Mount Tambora, New England Weather, and the Joseph Smith Family in 1816

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In April 1815 one of the largest volcanic eruptions on record occurred when Indonesia's Mount Tambora spewed large amounts of volcanic pollutants into the atmosphere. These airborne pollutants may have lowered ground temperatures and altered the New England weather during the spring and summer, thereby creating what has been called "the year without a summer." Thousands of New England farmers, including the Joseph Smith Sr. family, were affected by the unseasonably cold weather, which destroyed crops and forced families to relocate to other parts of the country.

The purpose of this paper is to briefly examine the possible relationship among the 1815 eruption of Mount Tambora, the 1816 weather conditions in New England, and the relocation of the Joseph Smith Sr. family. In doing so, we will begin with a historical overview of the eruption and its impact on atmospheric conditions, which in turn altered global weather conditions. This will be followed by a discussion of the colder New England weather conditions during the summer of 1816 that resulted from the volcanic ash, dust, and gases pushed into the atmosphere by Tambora's explosion. Finally, we will briefly examine how the unseasonable weather conditions in Vermont during the summer of 1816 affected the Joseph Smith Sr. family.

Historical Overview of the Mount Tambora Eruption

Mount Tambora is located on the north side of the island of Sumbawa, Indonesia (previously the East Indies). Prior to its eruption

in 1815, there is no evidence that any scientific study of Mount Tambora had ever taken place. It appears that the first scientist to explore the mountain was Heinrich Zollinger, a biologist who visited Tambora in 1847, thirty-two years after the volcano's eruption.[1] Based on his exploration of the mountain and interviews with a few people who survived the disaster, Zollinger described Tambora as having been conical with an estimated height of over four thousand meters (13,123 feet) prior to its eruption.[2]

The pre-eruption history of Tambora's volcanic activity is scanty at best. However, based on information from eyewitness accounts he collected in 1847, Zollinger reported that gases had begun escaping from fissures in the mountain as early as 1812, thereby creating a thick cloud that covered the upper part of Tambora. The dark cloud gradually extended down the mountainside, accompanied by rumblings and explosions that increased with intensity and frequency over the next few years.[3] On April 5, 1815, Tambora experienced a moderate eruption. Loud explosions, like the sound of cannon fire, were heard as far away as Makassar on the island of the Celebes (380 kilometers, or 236 miles, from Sumbawa), Batavia (Jakarta) on Java (1,260 kilometers, or 782 miles, from Sumbawa), and Ternate in the Molucaa Islands (1,400 kilometers, or 870 miles from Sumbawa).[4] These detonations grew weaker and sounded with less frequency until the evening of April 10, 1815.

At approximately seven in the evening on April 10, three separate columns of fire arose from Mount Tambora, quickly engulfing the mountain in what was described as liquid fire.[5] Two villages, Tambora and Sangaar, both located close to the mountain, were destroyed by falling debris and ash. At approximately ten that evening, a powerful and devastating whirlwind uprooted trees, destroyed homes, and carried away livestock and people.[6] Thunderous explosions punctuated the hot pyroclastic flow that continued to cascade down the sides of Tambora, consuming everything in its path. The explosions and fire continued into the next day, April 11. The awful sounds of Tambora's eruption on this day could be heard as far as 1,800 kilometers (1,118 miles) to the west and 1,400 kilometers (870 miles) to the east.[7]

When word of Tambora's eruption reached the island of Java, located west of Sumbawa, the British lieutenant governor of Java,

Sir Thomas Raffles, dispatched his assistant, Lieutenant Owen Phillips, to Sumbawa. Based on Phillips's report and information gathered from the surrounding islands, Raffles recorded the following:

> *Island of Sumbawa,* 1815.—In April, 1815, one of the most frightful eruptions recorded in history occurred in the province of Tamboro [*sic*], in the island of Sumbawa. . . . [It] began on April 5th, but was most violent on the 11th and 12th, and did not entirely cease till July. The sound of the explosions was heard in Sumatra, at the distance of 970 geographical miles in a direct line; and at Ternate, in an opposite direction, at the distance of 720 miles. Out of a population of 12,000 in the province of Tomoro, only 26 individuals survived. Violent whirlwinds carried up men, horses, cattle, and whatever else came within their influence, into the air; tore up the largest trees by the roots, and covered the whole sea with floating timber. Great tracts of land were covered by lava, several streams of which, issuing from the crater of the Tamboro Mountain, reached the sea. So heavy was the fall of ashes, that they broke into the Resident's house at Bima, 40 miles east of the volcano, and rendered it as well as many other dwellings in the town uninhabitable. On the side of Java the ashes were carried to the distance of 300 miles, and 217 towards Celebes, in sufficient quantity to darken the air. The floating cinders to the westward of Sumatra formed, on the April 12th, a mass 2 feet thick, and several miles in extent, through which ships with difficulty forced their way.
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> The darkness occasioned in the daytime by the ashes in Java was so profound, that nothing equal to it was ever witnessed in the darkest night. Although this volcanic dust when it fell was an impalpable powder, it was of considerable weight when compressed, a pint of it weighing twelve ounces and three quarters. . . .
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> Along the sea-coast of Sumbawa and the adjacent isles, the sea rose suddenly to the height of from 2 to 12 feet, a great wave rushing up the estuaries, and then suddenly subsiding. Although the wind at Bima was still during the whole time, the sea rolled in upon the shore, and filled the lower parts of the houses with water a foot deep. Every prow and boat was forced from the anchorage, and driven on shore. . . .
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> The tremulous noises and other volcanic effects of this eruption extended over an area of 1,000 statute miles in diameter, having Sumbawa at its centre. It included the whole of the Molucaa islands, Java, a considerable portion of the Celebes, Sumatra, and Borneo. In the island of Amboyna, in the same month and year, the ground opened, threw out water, and then closed again.[8]

The magnitude of Tambora's eruption is considered by some volcanologists to exceed that of any volcano in recorded history.[9] For example, the United States Geological Survey gives Mount Tambora a VEI (Volcanic Explosivity Index) of seven out of a possible eight, and this is the highest VEI that has ever been given to a volcano.[10] For example, Krakatau (1883) and Mount St. Helens (1989) rated a VEI of six and five respectively. Moreover, it is estimated that over 92,000 people were killed as a result of Tambora's eruption, compared with 36,417 deaths caused by the more well-known eruption of Mount Krakatau in 1883.[11] Of the estimated 92,000 people killed, 10,000 deaths were caused by falling debris, ash, and pyroclastic flow, while the remaining 82,000 were killed indirectly through starvation and disease.[12]

Tambora's Possible Impact upon Atmospheric Conditions

What effects did an eruption the size and magnitude of Tambora have on global weather patterns? Many scientists theorize that Tambora's volcanic ash and dust reduced incoming sunlight by reflecting the sun's rays back into space.[13] Additionally, other scientists have postulated that it was not just the presence of Tambora's volcanic ash and dust in the atmosphere that impacted global weather conditions but also the amounts of finer ash, aerosols such as sulfuric acid, and gas molecules that were pushed into the stratosphere (the layer seventeen kilometers or higher at the equator). These particulates were then carried by upper atmospheric winds around the earth for several years.[14] Indeed, later volcanic eruptions have demonstrated that particulates in the upper atmosphere may decrease the level of solar radiation by either absorbing it or reflecting the sun's radiation back into space, thereby lowering ground temperatures. The potential temperature loss that would follow a 10 percent blockage of the sun's radiation is as much as 6.15 degrees Celsius (11.07 degrees Fahrenheit).[15]

From the chemical composition of the volcanic rock found on Sumbawa, scientists have conjectured that Mount Tambora was the "pre-eminent volcanic pollution event in historic time" with heavy amounts of sulfur, chlorine, and fluorine being ejected into the earth's atmosphere.[16] Indeed, sulfur output during Tambora's erup-

tion on April 10, 11, and 12, 1815, may have been more than double the current annual total sulfur output of all volcanoes worldwide.[17]

Did these atmospheric pollutants alter the weather patterns of 1816, particularly in New England? Scientists generally accept that the global weather conditions for several years after the 1815 eruption can be linked to the activities of Tambora.[18] Daily temperatures in New England, particularly the daily minimums, were abnormally low from the latter part of spring through much of the fall, making 1816 "the year without a summer."[19] Northwest winds brought snow and frost to northern New England in June and July of 1816, destroying crops and causing havoc for the farmers.[20]

Possible Impact on New England Weather Patterns in the Summer of 1816

As previously noted, New England and other regions in the northern United States were affected by Tambora's eruption. In fact, New England, as well as portions of Europe, recorded record all-time seasonal low temperatures in 1816.[21] The unusual weather conditions of New England directly impacted crop production that year. Regional histories, personal diaries, and newspapers paint a vivid picture of the 1816 summer in New England as well as in other regions of the United States. David B. Thomas, a well-educated Pennsylvania Quaker, traveled for two months beginning May 21, 1816, throughout western New York and into Pennsylvania, Ohio, Kentucky, and Indiana. Thomas had an observant eye, and he carefully recorded weather, geologic details, road conditions, and flora wherever he traveled. In 1819 he published a book about his travels, which resulted in his appointment as the chief engineer on the western section of the Erie Canal.[22] Although his travels were farther south and west of New England, they demonstrate that colder-than-normal weather patterns existed in 1816. Thomas records the following details of his travels:

> [May 21, 1816, western New York] The season has been unusually cold, and vegetation proportionally retarded. The petals of the peach, and of the May duke cherry have fallen, while the apple, the pear, and the red cherry are in bloom. The leaves of the beech and of the maple are green, but not fully expanded.[23]

> [June 10, 1816, Pittsburg, Pennsylvania] On the day of our arrival in this city, we had several thunder showers from the west. The weather then became clear; and for three days we had brisk gales from the north-west, of unusual severity for summer. The surface of the rivers was rolled into foam, and each night was attended by considerable frost. Indeed, it still continues.
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> It is said here, (as at Scipio) that *the seasons* are much colder than formerly.[24]
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> [June 28, 1816, southern Ohio] The late frosts have been very severe. We saw neither peaches nor apples till we approached this river [Little Miami]; and, indeed even here, these fruits are scarce. Dead leaves, in tufts, are hanging on the papaw, and on most other trees,—the first growth of this spring having been entirely destroyed. This remark will apply to much of the state where we traveled.[25]
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> [July 1, 1816, Madison, Indiana] The peach trees, near this town were finely loaded with fruit, but those on the hills have been more injured by frost.[26]

Another historical description comes from the pen of Zadock Thompson (1796–1856), who describes the 1816 season in Vermont as "the coldest, and perhaps the dryest during the early part of summer, ever known."[27] Furthermore, he writes:

> Snow is said to have fallen and frosts to have occurred at some places in this State in every month of that year. On the 8th of June, snow fell in all parts of the State, and upon the high lands and mountains, to the depth of five or six inches. It was accompanied by a hard frost, and on the morning of the 9th, ice was half an inch thick on shallow, standing water, and icicles were to be seen a foot long. The weather continued so cold that several days elapsed before the snow disappeared. The corn, which was up in many places, and other vegetables, were killed down to the ground, and, upon the high lands, the leaves of the trees, which were about two thirds grown, were also killed and fell off. The summer was not only excessively cold, but very dry. Very little Indian corn came to maturity, and many families suffered on account of the scarcity of bread stuffs and their consequent high prices.[28]

Other accounts of the 1816 summer paint a similar picture. The Reverend Hosea Beckley, a distinguished clergyman of Vermont, described the unseasonable weather by stating: "The summer of 1816 was remarkably cold; and corn in this and other New England states was cut off by frost. It was a gloomy season; snow and

frost in June, and drying winds shortening much the crop of hay. It was so cold about the tenth or twelfth of September, that the water in ponds and rivers froze to some thickness."[29] The late summer cold and early fall freeze created an extremely short growing season. While it is clear from the New England weather records (1812–18) that the seven years preceding 1816 were cooler than normal, 1816 was an especially bad year for New England farmers because of the combination of colder summer temperatures, freezing rain, and killing frost. The dramatic weather changes during this summer had disastrous effects on the crops and brought about an exodus of Vermont farmers to regions with a greater likelihood of successful subsistence farming. The number of people leaving Vermont following the cold summer of 1816 is estimated at ten to fifteen thousand.[30] One scholar stated that the effects of this mass departure "set the growth of Vermont back about seven years. Those lost may well have been from amongst its most enterprising citizens."[31] One of the enterprising families included in this exodus was the family of Joseph Sr. and Lucy Mack Smith.

The 1816 Vermont Weather and the Joseph Smith Sr. Family

Following their marriage at Tunbridge, Vermont, on January 24, 1796, Joseph Smith Sr. and his wife, Lucy, moved numerous times in attempts to improve their financial condition. By 1812, the Smith family was living in Lebanon, New Hampshire, where they experienced numerous problems with their children's health.[32] Lucy states: "When health returned to us, as one would naturally suppose, it found us in quite low circumstances. We were compelled to strain every energy to provide for our present necessities, instead of making arrangements for the future, as we had previously contemplated. Shortly after sickness left our family, we moved to Norwich, in the state of Vermont."[33]

The date of their arrival in Norwich is uncertain. However, the family must have been living there during the spring of 1816, since Don Carlos, the ninth child in the Smith family, was born in Norwich, Vermont, on March 15, 1816.[34]

Did the Smith family fall victim to the unseasonable temperatures, snow, and frost that were brought on by Tambora's eruption

and that plagued New England farmers in the spring and summer of 1816? While Lucy Mack Smith mentions two successive crop failures before 1816, her brief narrative explaining the 1816 crop failure is most interesting. Lucy states, "The next year an untimely frost destroyed the crops, and being the third year in succession in which the crops had failed, it almost caused a famine."[35]

Lucy does not give any information regarding the first two crop failures or why they occurred, but she does inform us that it was the "untimely frost" that destroyed the third and final crop the family had attempted to grow in Norwich. The frost Lucy mentioned was typical of the weather other farmers encountered during the summer of 1816 and is consistent with the New England weather patterns associated with the aftermath of Tambora's 1815 eruption.

The Smith family, like hundreds of other farming families in the region, was affected by the abnormal, unseasonably colder weather. In fact, the killing frost may have played a key role in motivating Joseph Smith Sr. to relocate his family to Palmyra, New York, since Lucy writes: "This was enough; my husband was now altogether decided upon going to New York. He came in, one day, in quite a thoughtful mood, and sat down; after meditating some time, he observed that, could he so arrange his affairs, he would be glad to start soon for New York with a Mr. Howard, who was going to Palmyra."[36]

After settling as many of his business dealings as possible, Joseph Sr. left Norwich for Palmyra, New York, sometime in the summer of 1816.[37] Within a short time, the family, which had remained in Norwich, joined Joseph Sr. in Palmyra. In his own history, the Prophet Joseph Smith does not provide any reasons, such as the crop failure or the unseasonable weather, for their move to Palmyra. He simply states, "My father, Joseph Smith, Sen., left the state of Vermont, and moved to Palmyra, Ontario (now Wayne) county, in the State of New York, when I was in my tenth year, or thereabouts" (Joseph Smith—History 1:3).

It is likely that the Smiths were not aware of the Tambora eruption, or if they were, they did not link the unseasonably cold Vermont weather in 1816 to the effects of the volcano's pollutants upon the atmosphere and the attendant weather patterns.

Conclusion

The 1815 eruption of Mount Tambora destroyed numerous villages, killed thousands of people, and polluted the land and water sources within hundreds of miles of the eruption. Many others in the region died of starvation and disease because they could not grow food in soil that had been heavily polluted by volcanic ash and dust. Besides the immediate consequences of Tambora's eruption, however, there were residual consequences to the atmosphere and global weather patterns in other parts of the earth.

As we have discussed in this paper, New England's weather was adversely affected by Mount Tambora's eruption. Farmers living in New England, Vermont in particular, experienced colder than normal temperatures, freezing rain, frost, and snow during the summer of 1816. With the loss of their crops, large numbers of these New England farmers moved to more western states, such as New York. Thus, when viewed in the broader historical picture, the Smith family was part of a much larger migration of New England farmers hoping to find improved weather and farming conditions.

NOTES

[1]See Henry Stommel and Elizabeth Stommel, *Volcano Weather: The Story of 1816, the Year without a Summer* (Newport, RI: Seven Seas, 1983), 12.

[2]See H. Zollinger, *Besteigung des Vulkanes Tambora auf der Insel Sumbawa und Schilderung der Erupzion Desselben im Jahr 1815,* ed. J. Wurster (Winterthur: Zurcher and Furber, 1855). Note: Heinrich Zollinger, a biologist, was probably the first scientist to visit Tambora following the eruption. His 1847 visit resulted in the publication of a twenty-page pamphlet. The only known copy of this pamphlet is now in the British Museum Library, located in London, England. Consequently, it was unavailable for use as a primary source. When Zollinger is cited in this paper, it is from secondary source material, which may have had access to the pamphlet. Hence, this reference is from Zollinger's work as cited in Haraldur Sigurdsson and Steven Carry, "The Eruption of Tambora in 1815: Environmental Effects and Eruption Dynamics," *The Year without a Summer? World Climate in 1816,* ed. C. R. Harington (Ottawa: Canadian Museum of Nature, 1992), 16–45.

[3]See Sigurdsson and Carry, "The Eruption of Tambora in 1815," 16–45.

[4]See Richard B. Stothers, "The Great Tambora Eruption in 1815 and Its Aftermath," *Science* 224, no. 4654 (June 15, 1984): 1191–98.

[5]See Bernice de Jong Boers, "Mount Tambora in 1815: A Volcanic Eruption in Indonesia and Its Aftermath," in *Indonesia* 60 (1995): 36–60.

[6]See Sigurdsson and Carry, "The Eruption of Tambora in 1815," 16–45.

[7]See Stothers, "The Great Tambora Eruption in 1815 and Its Aftermath," 1191–98.

[8]Charles Lyell, *Principles of Geology or the Modern Changes of the Earth and Its Inhabitants* (London: John Murray, 1872), 104–5.

[9]See Stothers, "The Great Tambora Eruption in 1815," 1191–98.

[10]See United States Geographical Survey, "Comparisons with Other Eruptions," http://pubs.usgs.gov/publications/msh/comparisons.html (accessed October 10, 2002).

[11]See R. J. Blong, *Volcanic Hazards: A Sourcebook on the Effects of Eruptions* (New York: Academic Press, 1984), 73.

[12]See University of North Dakota Web site, "Tambora, Sumbawa, Indonesia," http://volcano.und.nodak.edu/vwdocs/volc_images/southeast_asia/indonesia/tambora.html (accessed November 8, 2002).

[13]See Stommel and Stommel, *Volcano Weather,* 11.

[14]See Stothers, "The Great Tambora Eruption in 1815," 1191–98.

[15]See W. J. Humphreys, *Physics of the Air* (New York: McGraw-Hill, 1940), 602, 605.

[16]Sigurdsson and Carry, "The Eruption of Tambora in 1815," 16–45.

[17]See Sigurdsson and Carry, "The Eruption of Tambora in 1815," 16–45.

[18]See Sigurdsson and Carry, "The Eruption of Tambora in 1815," 16–45.

[19]Stothers, "The Great Tambora Eruption in 1815," 1191–98.

[20]See Stothers, "The Great Tambora Eruption in 1815," 1191–98.

[21]See John D. Post, *The Last Great Subsistence Crises in the Western World* (Baltimore: Johns Hopkins University Press, 1977), 1.

[22]See David Thomas, *Travels through the Western Country in the Summer of 1816,* vol. 6 of the Contributions to the History of Geology Series (Darien, CT: Hafner, 1970), xi–xiv.

[23]Thomas, *Travels through the Western Country,* 1.

[24]Thomas, *Travels through the Western Country,* 55.

[25]Thomas, *Travels through the Western Country,* 105.

[26]Thomas, *Travels through the Western Country,* 118.

[27]Zadock Thompson, *Natural History of Vermont* (Rutland, VT: Charles E. Tuttle, 1972), 20.

[28]Thompson, *Natural History of Vermont,* 20.

[29]Hosea Beckley, *The History of Vermont; with Descriptions, Physical and Topographical* (Brattleboro, VT: George H. Salisbury, 1846), 171–72.

[30]See Stommel and Stommel, *Volcano Weather,* 94.

[31]Stommel and Stommel, *Volcano Weather,* 95.

[32]See Lucy Mack Smith, *History of Joseph Smith by His Mother,* Lucy Mack Smith (Salt Lake City: Bookcraft, 1901), 51–58.

[33]Smith, *History of Joseph Smith by His Mother,* 59.

[34]See Smith, *History of Joseph Smith by His Mother,* 59, see footnote.

[35]Smith, *History of Joseph Smith by His Mother,* 59.

[36]Smith, *History of Joseph Smith by His Mother,* 59–60.

[37]See Smith, *History of Joseph Smith by His Mother,* 60.