John Winthrop's Lecture on Earthquakes (1755) and "Pestilential Distempers" Caused by Environmental Disruption

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> John Winthrop, *A lecture on earthquakes; Read in the Chapel of Harvard-College in Cambridge, N.E. November 26th 1755. On Occasion of the great earthquake which shook New-England the Week before* (Boston: Printed and Sold by Edes & Gill, at their Printing-Office next to the Prison in Queen-Street, 1755)
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> Harvard University Archives, HUC 8755.295

Introduction

In 1755, a professor at a small school in Cambridge, Massachusetts gave a lecture on "the general causes of earthquakes."[1] John Winthrop, professor of mathematics and philosophy at Harvard College, was prompted by a recent earthquake that had struck the Boston area early on the morning of November 18, 1755, causing widespread damage and fright.

In his lecture, Professor Winthrop tackled a question at the heart of such upheaval: why did earthquakes occur? Winthrop's argument was that earthquakes were caused by movement of pent-up forces in chambers beneath the earth's surface. Under sufficient pressure, subterranean and threatening vapors exploded and burst forth, with malign consequences for human health. As he explained, "These vapors may possibly sometimes infect the air, and bring on pestilential distempers, which have been said to be consequent upon great earthquakes."[2]

Earthquakes, in other words, caused disease—not, as many today fear, through exposure to the elements and the crowding-together of survivors in unsanitary conditions, but because the very disturbance of the earth could "infect the air," which would in turn make people sick. The same disturbances that shook the earth would create airborne sources of human disease.[3]

John Winthrop was only one of many men in the busy publishing world of colonial Boston to expound upon this earthquake. Many clerics preached sermons on the tremor, interpreting its spiritual meaning. The plethora of newspaper stories on the earthquake and its causes suggests conversations taking place in streets and alleys, over shop counters and kitchen tables.[4] This lively printed discussion reveals how literate people in the English colonies understood events and transformations within their natural environs. Winthrop's contribution to this conversation reveals the deep connections understood to exist in the late-18th-century Atlantic world between human beings and their surroundings—indeed, the globe itself. In this understanding of environmental interconnection, the earth was riven with chambers through which winds and fluids could flow. These functioned much as the veins and arteries of the human body. Conditions of proper balance created health in the human body and seismic stability in the earth. Volcanoes and earthquakes, though, were caused by the restless movement of these underground fluids and winds. When earthquake or eruption loosed these subterranean forces into the above-ground world, they disrupted the air itself. In the powerful and pervasive miasmatic theory of disease, such harmfully fouled air—known as miasma—would surround and be breathed in by vulnerable human bodies, causing many of the diseases that plagued humanity. Winthrop's earthquake lecture thus indicates the widespread assumption that people and their places were inextricably linked, and that geological disruption could be a significant cause of human disease.

The Cape Ann Earthquake

The Cape Ann earthquake, as it is now called, shook the region enough to wake sleepers and send frightened townspeople out into the streets in their nightclothes. It

tumbled many area chimneys, leveling some off at the roofline. The quake broke roofs and gable ends across Boston and surrounding communities and disrupted local well-springs. It caused land to slump into Boston harbor and broke the weathervane atop Faneuil Hall. In nearby settlements, the tremors apparently caused sandblows (alarming extrusions of liquefied earth) to erupt beneath several cellars. The quake was widely felt across much of New England and into maritime Canada. Twenty-first-century seismologists estimate that the tremor was epicentered offshore, approximately 40 km east-northeast of Cape Ann (the small peninsula just above Boston that marks the northern edge of Massachusetts Bay), with a moment magnitude close to 6.0.[5]

The historical record of the Cape Ann earthquake helps shape modern assessment of Boston's earthquake risk. A 2012 study estimated that a repeat of a Cape Ann-sized event would injure 500 people, damage about that many buildings, and cause direct damage of about $2.6 billion as well as loss of economic activity costing roughly $3.4 billion.[6] Even comparatively moderate earthquake waves travel better and further in eastern North America than they do in western areas such as California, because the rocks are in geologic terms older and denser. Despite this hazard, few East Coast structures have been built with earthquakes in mind.[7]

In 1755, the earthquake was a major event. Winthrop's lecture detailed his own careful observations of how the disturbance had unfolded. He had stored a glass tube he had been using for experiments inside the case of a clock. The jarring motion of the tremor lodged the tube against the pendulum, stopping the clock's motion. Even so, he was able to calculate the long duration of the shock—at least four minutes!—as he had checked his watch for accuracy the day before.[8] He took similar precision in calculating the velocity of the shock by how far bricks were thrown from his chimney and noted the qualities of seismic movement: mostly horizontal, like that of a tremulous sea.[9] Along with many of his contemporaries, he was interested in causal ties between weather and other natural events, so he also noted the heavy frost the day following the temblor.[10]

Winthrop's main assertions concerned the fundamental causes for such frightening events. He explained:

The earth is not solid throughout, but contains within it many large holds, pits, and caverns; as is agreed by all Natural Historians. There are very probably also long, crooked, unequal passages, which run winding through a great extent of earth, and form a communication between very distant regions. Some of these cavities are dry, and contain nothing but air, or the fumes of fermenting minerals; in others, there are currents of water.[11]

When blocked,

the vapors produced from hence will rush along through the subterraneous grottos, as they are able to find or force for themselves a passage; and by heaving up the earth that lies over them, will make that kind of progressive swell or undulation, in which we have supposed earthquake commonly to consist; and will at length burst the caverns with a great shaking of the earth, as in springing a mine; and so discharge themselves into the open air.[12]

Earthquakes thus had the same essential cause as volcanoes: fumes or fluids moving through underground passages, whose disturbances communicate themselves to the surface of the planet.[13]

John Winthrop enlarged his initial lecture into a letter to a colleague in England which was later published (as was common practice for such correspondence) in a leading journal of scientific conversation of the era, the *Philosophical Transactions of the Royal Society of London*.[14] Winthrop's earthquake theorizing was part of his larger body of work that led contemporaries to recognize him alongside Benjamin Franklin as a leading intellectual of the colonies.[15]

Winthrop was thus a key figure in discussions of the natural world, and his views both shaped and reflected scientific discourse. In his understanding of how the physical world could affect human well-being, Winthrop likewise expressed main currents of thinking in the 18th-century Atlantic world. His contention that the earth itself would communicate "pestilential distempers" to hapless communities was no idiosyncrasy. Rather, his almost off-handed reference to the connection between disruption of the natural world and that of human bodies is indicative of thinking about natural causes and about human health before the late-19th- and early-20th-century ascendance of germ theory. His remarks indicate how profoundly disease was regarded as a phenomenon not simply of people, but of people in connection with their surroundings.

Views of the Earth

As was typical of both learned and less learned people of his time and culture, John Winthrop drew on a pervasive, organic notion of the cosmos. The earth, in long Western tradition, was not inert matter but an embodied mass obeying many of the same imperatives as living creatures such as cattle, oak trees, or human beings. Agricultural fields vivify growing crops, after all. Crystals grow much as children do; the earth has veins of precious metals like the veins of a human body. By the 18th century, new and more mechanistic modes of explanation were beginning to supplant

this framework, in emphasis if not in totality, but a powerful organic worldview continued to shape both elite and common understanding.[16]

In articulating connections that spanned the now-distant disciplines of human health and geophysics, Winthrop's thinking was typical of the natural philosophy of his time, the endeavor that would gradually grow, morph, and subdivide into the modern sciences. Winthrop's scientific undertakings and those of his intellectual community were closely related to both spiritual and social understandings of events.[17] Such integrative ways of understanding the world were long-standing in European learning, and they endured well into the 18th century. To describe the health prospects of a given place meant in part to chronicle its rocks and its native peoples; to study the stars was also to understand more about the growing of crops.[18]

In Winthrop's arguments, earthquakes and the earth's fertility existed in constant, dynamic connection. As he observed, because of the potential for disturbance from underground passages, "the earth contains within itself the seeds of earthquakes in great abundance."[19] The salutary effect of earthquake, though, is "to loosen and disunite the parts of the earth, and to open it's pores"[20]—and such "loosening of the part of the earth may promote even the growth of vegetables on it's surface."[21] Earthquakes tilled the soil like farmers preparing fields in early spring.

Seismic stillness or movement was understood to have particularly intimate connections with the lived, bodily experience of human beings and animals alike. One's own body functioned as an "instrument of seismic disruption:" the earth's movement registered in and through the sensations of bodily form.[22] Such indications were not incidental, but fundamental: those in the European diaspora regarded the workings of the earth as intimately connected with the well-being and physicality of living creatures. (Similar beliefs were held by many other cultures, too, including New England tribal nations and those with roots in Africa, but the textual record of this earthquake gives us direct access specifically to the Euro-American cultural and intellectual tradition.) Certain diseases, therefore, could be understood as a manifestation of natural phenomena.

Winthrop's assertion that environmental upheaval would result in human illness was consistent with many writings of his time and decades after. The patriot, intellectual, and lexicographer Noah Webster, for example, amassed a mammoth history of natural phenomena—earthquakes, volcanoes, eclipses, and the like—which he argued gave historical evidence of a causative relationship between these disruptions of the natural order and epidemics. Like Winthrop, Webster observed that human disease originated in "the noxious vapour ejected by the convulsions of the earth and eruptions." Outbreaks of disease resulted not from discrete sources of contagion, but

from an “epidemic constitution” of a place, often one created by environmental disruption.[23]

Winthrop’s emphasis upon the power of moving air currents within the earth was likewise consistent with geological understanding of his time. Vapors within passageways or chambers far under the earth were understood to link volcanoes and earthquakes. Pressure from underground vapors would spew up in an eruption, or press against the surface of the earth, causing it to shake or even buckle.[24] Such an understanding of a multiple-channeled earth connected with miners’ experiences of natural spaces underground and the occasional glimpse offered to other surface-dwellers with the collapse of a sinkhole or the opening of a cave.[25] Chambers within the earth were sometimes described as underground rivers: different qualities of air flowed underneath the earth, much as minerals did in glittering veins.

The notion that the earth’s vapors would create human disease drew not only on geological conceptions, but on medical ones, specifically on the long-standing—indeed ancient—notion of miasma. Crucial but protean, powerful but only indirectly sensed, miasmas were invisible emanations often carried on baleful breezes from swamps, lowlands, or piles of rot. Miasmas conveyed the essence of an environment into the vulnerable human form. The miasmatic theory of disease suggested why damp and smelly places were unhealthy, and it provided an explanation for the propagation of disease. Illness spread like a malevolent fog throughout households and communities, across harbors, and down river valleys. This understanding of disease was widespread and influential, and endured despite seemingly conflicting explanatory schemes that identified microscopic pathogens as the culprit for infectious disease.[26] John Winthrop’s earthquake theorizing thus indicates a powerful concept of disease that did not center on human-to-human contact, but rather situated human beings as just one part in a vulnerable, natural system.

God, Humanity, and “Iron Points”

Winthrop’s lecture also launched an early and influential feud over earthquake causation.[27] His naturalistic arguments for why earthquakes occur rubbed raw many of his godly contemporaries. They argued that earthquakes were a call not to theorizing, but to repentance. One Boston pastor particularly criticized how scientific interpretation might shape common understanding of the fearsome recent quake. The Rev. Thomas Prince of Boston’s South Church observed that the earthquake struck not long after many in Boston had adopted a new fire-prevention measure, Benjamin Franklin’s “iron points” (lightning rods). That boldness, he argued, had channeled lighting—long recognized as the agent of God’s judgment—down into the earth. Once

there, the “electrical fluid” was stirring up harmful quakes. Temerity was to blame for Boston’s earthquake: temerity and the arrogance of sidestepping righteous wrath. Winthrop and Price lobbed earthquake theories back and forth at each other across the Charles River for several months, as the pastor warned the earthquake was a response to human action and the Harvard professor insisted on natural causes.[28] Historians have by and large concluded that Winthrop bested Prince, but the pastor successfully convinced at least some contemporaries that lightning rods were, in John Adams’s words, an “attempt to robb the almighty of his Thunder, to wrest the Bolt of Vengeance out of his Hand.”[29]

Conclusion

Discussion of the Cape Ann earthquake, including the debate over “iron points,” makes clear that causation of phenomena from lethal epidemics to alarming earthquakes remained an active area of dispute in the 18th century.[30] Such debates intensified with news of the far more devastating earthquake and tsunami which struck off the coast of Lisbon, Portugal, on All Saints Day, November 1, 1755. The awesome power and fearsome destructiveness of the great Lisbon earthquake shaped scientific understanding and philosophical understanding of earthquakes toward modern seismology.[31] But in the more parochial discussion of a far gentler, if still frightening, New England tremor, emerge important ideas of how human beings related to the earth around them and understood the diseases from which they suffered.

Notes

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[1] John Winthrop, *A lecture on earthquakes; Read in the Chapel of Harvard-College in Cambridge, N.E. November 26th 1755. On Occasion of the great earthquake which shook New-England the Week before* (Boston: Printed and Sold by Edes & Gill, at their Printing-Office next to the Prison in Queen-Street, 1755), 24.

[2] Winthrop, *A lecture on earthquakes*, 25.

[3] John T. Watson, Michelle Gayer, and Maire A. Connolly, "Epidemics after Natural Disasters," *Emerging Infectious Diseases* 13, no. 1 (January 2007): 1–5. Modern fears of post-earthquake epidemic have been stoked by an epidemic of cholera that ravaged Haiti for the first time in its history following a devastating earthquake in 2010. Many Haitians and epidemiologists blamed UN peacekeepers, and in 2016 the UN formally acknowledged that their personnel had indeed been responsible for the outbreak. Only in 2020 was the epidemic brought to an end by public health campaigns, after 820,000 cases and nearly 10,000 deaths. Jonathan M. Katz, "U.N. Admits Role in Cholera Epidemic in Haiti," *The New York Times*, August 17, 2016. https://www.nytimes.com/2016/08/18/world/americas/united-nations-haiti-cholera.html; Centers for Disease Control and Prevention (CDC), "Cholera in Haiti" (updated February 5 2021), https://www.cdc.gov/cholera/haiti/index.html; United Nations (UN), "Haiti cholera outbreak 'stopped in its tracks,'" January 20, 2020. https://news.un.org/en/story/2020/01/1056021.

[4] Whitney Barlow Robles, "Atlantic Disaster: Boston Responds to the Cape Ann Earthquake of 1755," *The New England Quarterly* 90, no. 1 (March 2017): 7–35, here 13 and 25; Charles Edwin Clark, "Science, Reason, and an Angry God: The Literature of an Earthquake," *The New England Quarterly* 38, no. 3 (September 1965): 340–62, esp. 32 and 344; see also ch. 6, 104–131 in John E. Ebel, *New England Earthquakes: The Surprising History of Seismic Activity in the Northeast* (Guilford, CT: Globe Pequot, 2019). On sermons, see Thomas Foxcroft, *The Earthquake, a Divine Visitation: A Sermon Preached to the Old Church in Boston, January 8, 1756. Being a Day of Publick Humiliation and Prayer, Throughout the Province of Massachusetts-Bay in New-England: Upon Occasion of the Repeated Shock of an Earthquake on This Continent, and the Very Destructive Earthquakes and Inundations in Divers Parts of Europe, All in the Month of November Last* (Boston: Printed and sold by S. Kneeland, and T. Rand, 1756), Tract BG43, Boston Athenæum. Several enterprising preachers advertised their published sermons on the earthquake, and in late February, a reader wrote in to cite still another sermon on the subject (*Boston Gazette, or Country Journal, Containing the freshest Advices Foreign and Domestick*, January 26, 1756): 2; a message from "one of your constant Readers" published after Prince's reply in the February 23, 1756 edition of the *Boston Gazette*, cited Thomas Foxcroft's sermon from the previous month. Sermons connected to the Cape Ann earthquake show how much these disturbing events were regarded as signs whose meaning needed to be discerned. Even as mechanistic ideas gained force over providential interpretations into the 18th century, people still sought religious explanation, especially in regions such as New England, where earthquakes were infrequently felt. Lauri Bauer Coleman, "'Rain Down Righteousness': Interpretations of Natural Events in Eighteenth-Century Boston," in *Remaking Boston: An Environmental History of the City and Its Surroundings*, ed.

Anthony N. Penna and Conrad Edick Wright, (Pittsburgh: University of Pittsburgh Press, 2009), 233–58; Matthew Mulcahy, "The Port Royal Earthquake and the World of Wonders in Seventeenth-Century Jamaica," *Early American Studies* 6, no. 2 (Fall 2008): 391–421, esp. 413–15.

[5] Chapter 6: "1744: Another Earthquake Shocks Massachusetts; 1755: The Great Cape Ann Earthquake," in Ebel, *New England Earthquakes*. For location and magnitude estimates, see p. 130: the full estimated range is between 5.6 and 6.6. For people aghast and unclothed in the street, see "A LETTER, giving an Account of the most dreadful EARTHQUAKE that has ever happen'd since the first Settlement of New-England," letter appended to Thomas Prince, "An Improvement of the Doctrine of Earthquakes Being the Works of God, and Token of His Just Displeasure: Containing a Historical Summary of the Most Remarkable Earthquakes in New-England, from the First Settlement of the English Here, as Also in Other Parts of the World since 1666" (Boston: D. Fowle & Z. Fowle, 1755), Boston Athenæum, Tract B43, p.16.

[6] Ebel, *New England Earthquakes*, 277.

[7] US Geological Survey, "East vs West Coast Earthquakes: Fewer Quakes but Bigger Stakes in the East" (updated Apr. 14, 2018), https://www.usgs.gov/news/east-vs-west-coast-earthquakes. Jeremy Miller, "Boston's Earthquake Problem: It's Not the Likelihood of a Major Earthquake That Makes Experts Tremble—Though It's Worse Than You Think. It's the Damage One Would Do—Because It's Much Worse Than You Think," *Boston Globe Magazine*, May 28, 2006.

[8] Winthrop, *A lecture on earthquakes*, 9–10.

[9] Winthrop, *A lecture on earthquakes*, 10, 13.

[10] Winthrop, *A lecture on earthquakes*, 17.

[11] Winthrop, *A lecture on earthquakes*, 18–19.

[12] Winthrop, *A lecture on earthquakes*, 23–24.

[13] Contemporary seismology also asserts relationships between volcanoes and earthquakes, though on somewhat different causal grounds. Gilles Seropian, Ben M. Kennedy, Thomas R. Walter, Mie Ichihara, and Arthur D. Jolly, "A Review Framework of How Earthquakes Trigger Volcanic Eruptions," *Nature Communications* 12, no. 1004 (2021); David P. Hill, Fred F. Pollitz, and Christopher G. Newhall, "Earthquake–Volcano Interactions," *Physics Today* 55 (2002): 41–47.

[14] John Winthrop, "An Account of the Earthquake Felt in New England, and the Neighbouring Parts of America, on the 18th of November 1755. In a Letter to Tho.

Birch, D. D. Secret. R. S.," *Philosophical Transactions of the Royal Society of London* (1757).

[15] Winfred E. A. Bernhard, "Winthrop, John (8 December 1714–3 May 1779)," in *American National Biography* (Oxford: Oxford University Press, 1999), https://doi.org/10.1093/anb/9780198606697.article.1301840. Robles, "Atlantic Disaster," 18; Clark, "Science, Reason, and an Angry God," 348–49. On the rejection in modern seismology of first-person accounts, despite their centrality in the making of that science, see Deborah R. Coen, *The Earthquake Observers: Disaster Science from Lisbon to Richter* (Chicago; London: University of Chicago Press, 2012). On Franklin, see Joyce E. Chaplin, *The First Scientific American: Benjamin Franklin and the Pursuit of Genius* (New York: Basic Books, 2006).

[16] David Roger Oldroyd, "A Mythical and Living World," 7-41, and "'Mechanical' Theories of the Earth and Physico-theology," 42–58, in *Thinking About the Earth: A History of Ideas in Geology* (Cambridge, MA; London: Harvard University Press, 1996). As Oldroyd notes in ch. 12, "Some Grander Ways of Thinking," 283–305, geologists of the late 20th century began to return to such ideas. Rachel Laudan notes the long persistence of very old Aristotelian ideas about the substances of the world; key explanatory concepts have long staying power: Laudan, *From Mineralogy to Geology: The Foundations of a Science, 1650–1830* (Chicago: University of Chicago Press, 1987), 30. See also Donald Worster, "Healing the Planet," in *Nature's Economy: A History of Ecological Ideas, Studies in Environment and History*, ed. Donald Worster and Alfred Crosby (Cambridge: Cambridge University Press, 1994), 342–387.

[17] Robles, "Atlantic Disaster," 8, makes this point about the Cape Ann earthquake. Early 21st-century histories of American science have made this argument more broadly. See, for example, Cameron B. Strang, *Frontiers of Science: Imperialism and Natural Knowledge in the Gulf South Borderlands, 1500–1850* (Williamsburg; Chapel Hill: The Omohundro Institute of Early American History and Culture; University of North Carolina Press, 2018); Emily Pawley, *The Nature of the Future: Agriculture, Science, and Capitalism in the Antebellum North* (Chicago; London: University of Chicago Press, 2020); Conevery Bolton Valencius, "Vernacular Science: Knowing Earthquakes in the Early United States," in *The Lost History of the New Madrid Earthquakes* (Chicago: University of Chicago Press, 2013), 175–215; Valencius, David I. Spanagel, Emily Pawley, Paul Lucier, and Sara Sidstone Gronim, "Science in Early America: Print Culture and the Sciences of Territoriality," *Journal of the Early Republic* 36, no. 1 (Spring 2016): 73–123; and Valencius, *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002).

[18] Emily Pawley, “Reading the Man of Signs, or, Farming on the Moon,” *Commonplace* 14, no. 4. (Summer 2014); Valencius, “Local Knowledge: Medical Geography and the Intellectual Hinterland,” in *The Health of the Country*, 159–190.

[19] Winthrop, *A lecture on earthquakes*, 26.

[20] “it’s” in the original: 18th-century orthography was colorfully varied, and it’s/its was no exception. Winthrop, *A lecture on earthquakes*, 29.

[21] Winthrop, *A lecture on earthquakes*, 30.

[22] Valencius, “The Quaking Body: Sensation, Electricity, and Religious Revival,” in *Lost History*, 145–174, here 150. Deborah R. Coen, “Introduction: Witness to Disaster: Comparative Histories of Earthquake Science and Response” *Science in Context* 25, no. 1 (2012): 1–15, and other articles in this special issue of *Science in Context*, including Coen, “The Tongues of Seismology in Nineteenth-Century Switzerland,” 73–102; Paul White, “Darwin, Concepción, and the Geological Sublime,” 49–71; Conevery Bolton Valencius, “Accounts of the New Madrid Earthquake: Personal Narratives Across Two Centuries of American Seismology,” 17–48; and especially on animal bodies, Fa-Ti Fan, “‘Collective Monitoring, Collective Defense’: Science, Earthquakes, and Politics in Communist China,” 127–54. On animals, see also Robles, “Atlantic Disaster.” On the broader history of the body as instrument, see Linda Nash, “The Historical Experience of Nature: Historical Encounters with a Northwest River,” *Journal of American History* 86, no. 4 (2000): 1600–29; and Melanie Kiechle, *Smell Detectives: An Olfactory History of Nineteenth-Century Urban America* (Seattle: University of Washington Press, 2017).

[23] Noah Webster, “On the Connections of Earthquakes with Epidemic Diseases,” *Medical Repository* 4 (1801): 340–344, quotation on p. 341. On Webster and similar 19th-century arguments about earthquakes and health, see Valencius, *The Lost History*, 149 and bibliographic note 4.1, p. 413. For a beautiful discussion of Webster’s and others’ historical arguments, see Thomas Apel, “The Thucydidean Moment: History, Science, and the Yellow-Fever Controversy, 1793–1805,” *Journal of the Early Republic* 34, no. 3 (Fall): 315–47.

[24] Oldroyd, *Thinking About the Earth*. On vapors, see Winthrop’s fellow Cape Ann commentator, Rev. Matthew Byles, *Divine Power and Anger Displayed in Earthquakes: A Sermon occasioned by the Late Earthquake in New-England, November 18, 1755 and Preached the Next Lord's-Day, at Point-Shirley* (Boston: Printed and sold by S. Kneeland in Queen-Street, 1755), Tract B43, Boston Athenæum. For context, see Robles, “Atlantic Disaster.”

[25] On underground space, see Robert Macfarlane, *Underland: A Deep Time Journey* (New York; London: W.W. Norton, 2019). Nearby earthquakes can indeed produce a hollow booming sound which is remarkably suggestive of a hollow chamber underground, even to modern seismologists who know the earth beneath them is solid (John E. Ebel, personal communication, March 7, 2021).

[26] On miasma, see "Airs," in Valencius, *The Health of the Country*, 109–132; Kiechle, *Smell Detectives*; Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2007); Gregg Mitman, Michelle Murphy, and Christopher Sellers, "Introduction: A Cloud over History," in Landscapes of Exposure: Knowledge and Illness in Modern Environments, *Osiris* 19 (2004): 1–17; Warwick H. Anderson, "Natural Histories of Infectious Disease: Ecological Vision in Twentieth-Century Biomedical Science," in Landscapes of Exposure: Knowledge and Illness in Modern Environments, *Osiris* 19 (2004): 39–61. On ideas relating to disease that have similar functions in modern understanding, see Gregg Mitman, *Breathing Space: How Allergies Shape Our Lives and Landscapes* (New Haven: Yale University Press, 2008); Michelle Murphy, "The 'Elsewhere within Here' and Environmental Illness; or, How to Build Yourself a Body in a Safe Space" *Configurations* 8, no. 1 (2000): 87–120; and *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers* (Durham: Duke University Press, 2006).

[27] Feuding over earthquakes is something of a tradition in seismology: Valencius, *Lost History*, 292–302; Susan E. Hough, *The Great Quake Debate: The Crusader, the Skeptic, and the Rise of Modern Seismology* (Seattle: University of Washington Press, 2020).

[28] Winthrop even paid for a multi-page letter to be printed and delivered alongside the local newspaper, lambasting the scientific claims of his reverend adversary. Important moments of their debate: Within a week following the November 18 earthquake, Thomas Prince republished a sermon he had originally given after a 1727 tremor, adding a first-hand account he had received describing the recent earthquake: "Earthquakes the Works of God, and Tokens of His Just Displeasure: Being a Discourse on That Subject Wherein Is Given a Particular Description of This Awful Event of Providence. And among Other Things Is Offer'd a Brief Account of the Natural, Instrumental, or Secondary Causes of These Operations in the Hands of God. After Which, Our Thoughts Are Led up to Him, as Having the Highest and Principal Agency in This Stupendous Work," (Boston: D. Fowle and Z. Fowle, 1755), Boston Athenæum, Tract C21. On November 26, Winthrop delivered his public lecture on the science of earthquakes at Harvard College. On December 6, Prince then revised and re-published his sermon, adding additional speculation about the causes of the most

recent temblor: “An Improvement of the Doctrine of Earthquakes Being the Works of God, and Token of His Just Displeasure: Containing a Historical Summary of the Most Remarkable Earthquakes in New-England, from the First Settlement of the English Here, as Also in Other Parts of the World since 1666” (Boston: D. Fowle & Z. Fowle, 1755), Boston Athenæum, Tract B43. Meanwhile, Winthrop hustled his own lecture into print on December 20: Winthrop, *A lecture on earthquakes*. After that, the debate moved onto the pages of the Boston Gazette: Prince, letter dated January 15, 1756, *Boston Gazette, or Country Journal, Containing the freshest Advices, Foreign and Domestick*, January 26, 1756; Winthrop, “A Letter to the Publishers of the Boston Gazette, &C. Containing an Answer to the Rev. Mr. Prince’s Letter, Inserted in Said Gazette, on the 26th of January 1756,” separate pamphlet accompanying the Boston Gazette, January 28, 1756; Prince, letter dated February 12, 1756, *Boston Gazette*, February 23, 1756; Winthrop, letter dated February 24, 1756, *Boston Gazette*, March 1, 1756. The following year Winthrop’s account appeared in a British scientific journal: Winthrop, “An Account of the Earthquake Felt in New England.”

[29] Adams quoted in Robles, “Atlantic Disaster,” 24. Robles argues that most historians have misrepresented this dispute and that at the time many people regarded Prince as having triumphed over Winthrop. On the “iron points” debate, see Clark, “Science, Reason, and an Angry God”; Eleanor M. Tilton, “Lightning-Rods and The Quaking Body: Sensation, Electricity, and Religious the Earthquake of 1755,” *New England Quarterly* 13, no. 1 (March 1940): 85–97; Valencius, *Lost History*, 211.

[30] Robles, “Atlantic Disaster,” 24.

[31] Robles, “Atlantic Disaster,” 29–34; Coen, *Earthquake Observers*, 7–8.