Tectonic Microphonics

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In nineteenth-century India, they were called Barisal guns. In Mexico, they were *bramidos*. In the Netherlands, *Mistpouffers*. And, in Italy, *balza, marina,* or *Rombo*.[1] Alexander von Humboldt described these peculiar sounds in *Cosmos*:

> The sound was clearly not propagated through the air, but through the earth, and at a great depth. The most striking instance of uninterrupted subterranean noise, unaccompanied by any trace of earthquake, is the phænomenon which is known in the Mexican territory by the name of "the subterranean roaring and thundering, (bramidos y truenos subterraneos) of Guanaxuato." . . . The noise began on the 9th of January, 1784, at midnight and lasted above a month. . . . It was as if there were heavy storm clouds under the feet of the inhabitants.[2]

These mysterious subterranean sounds were the sonic report of what Charles Lyell referred to in 1830 as "worlds . . . beyond worlds, immeasurably distant from each other."[3] Through their study of the Earth's subterranean structure, including the sounds it released, geologists and seismologists imagined they uncovered the "confines of the visible universe" in the stratified, oscillating soil.[4]

Carolyn Abbate has shown that, practically since its invention in 1878, the carbon microphone was understood as providing enhanced sensory access to the natural world: D. E. Hughes famously called the apparatus "a gateway for small sounds," like the tread or even the respiration of a gnat, offering "new secrets

[1]William Hobbs, *Earthquakes: An Introduction to Seismic Geology* (New York: Appleton, 1907), 212.
[2]Alexander von Humboldt, *Cosmos*, trans. Edward Sabine (London: Longman, 1846), 196.
[3]Stephen Jay Gould, *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge, MA: Harvard University Press, 1987), 2.
[4]Gould, *Time's Arrow, Time's Cycle*, 2.

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from the storehouse of nature."[5] Abbate suggests that fantasies of the microphone facilitating augmented sensory enhancement endure today, reflecting the persistent allure of the device and its capabilities as well as the broader tendency to link sound objects to specific cultural phenomena and modes of listening. Pressing the microphone to the subterranean, in the years around 1900, seismologists imagined the device was a "gateway" to geophysical activity that lay beyond human acuity, including the *bramidos* Humboldt described.

Seismologists' enthusiastic embrace of the microphone is not so surprising. After all, their field relied on instrumental analysis of tectonic motion as a means of predicting oncoming natural disasters, from lava flows to earthquakes. Their conviction of the credibility of instruments did, however, present the microphone as a tool for professionalizing an entirely new category of geophysical data—seismic sound—previously regarded as mere lay-knowledge, gossip, or material for *fin-de-siècle* "disaster literature," in a moment when seismology was emerging as a modern, observational field.[6] As seismologists rushed to apprehend credible knowledge of planetary sounds via this new device, they represented these sounds across a range of rhetorical registers that both trouble and affirm Jonathan Sterne's assessment of the "emergence of rationalized listening" alongside new listening devices as marked by "logic, analytic thought, industry, professionalism, capitalism, [and] individualism."[7] Some seismologists' language was analytical, some indexed the microphone's participation in electrical modernity, and some—in keeping with Hughes's microphonic fantasies—glorified its ability to extend the user's aural acuity into a super-human realm of global nature.

This article shows that seismologists' poetics of planetary sound—their nomenclature, codes, signifiers, and metaphors—expose the wide-ranging political stakes of their endeavors. Drawing on accounts of experimental work with the microphone in Italy and Japan in the decades around 1900, I argue that the device supported a new approach to geophysical inquiry that placed nations' globalizing impulses at center stage. Exploding the presence of "the human" in environmental space, the microphone was treated as an exclusive "gateway" into the vast morass of planetary time and space: it allowed seismological representatives of emerging nation-states and expanding empires to claim new forms of subterranean occupation stemming from their rarified possession of the silent "voice" of nature and privileged ability to apprehend predictive signals of earthly natural disasters. As I show, historical actors seemed to marshal the device, its fantastical allure, and its revelatory capabilities in service of imperial bids for geopolitical power and smaller-scale national interests, their aural domination of the environment facilitating, in some cases, extractive economies of fossil capitalism and their infrastructures of racialized oppression.

As Stephen Jay Gould has shown, geologists had long analogized planetary structure to ideals of social hierarchy, order, and organization.[8] As I argue in the first part of this article, post-unification Italian seismologists who initiated this practice at Mount Vesuvius extended this epistemological trend: they presented their enhanced access to seismic sound as an index of Italian modernity and long-term resilience against environmental destruction, powerful metrics of geopolitical prosperity, national security, and even racial development in this period. In the middle sections of the article, I ask how the politics of microphonic listening emerged not just around the device's *use*, but through

[5]Carolyn Abbate, "Sound Object Lessons," *Journal of the American Musicological Society* 69, no. 3 (2016): 807. On early responses to Hughes's device, see also Douglas Kahn, *Earth Sound Earth Signal* (Berkeley: University of California Press, 2013), 35–37. "Microphone and Its Allies," *World of Wonders*, Pt. 1 (London: Cassell, Peters & Galpin, 1883), 400.
[6]Deborah Coen, *The Earthquake Observers: Disaster Science from Lisbon to Richter* (Chicago: University of Chicago Press, 2012), 16–17.
[7]Jacob Smith, *Eco-Sonic Media* (Berkeley: University of California Press, 2015), 84; Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham: Duke University Press, 2003), 95.
[8]See Gould, *Time's Arrow, Time's Cycle*. On the political metaphors embedded in geological historiographies, see also Paolo Rossi, *The Dark Abyss of Time: The History of the Earth and the History of Nations, from Hooke to Vico*, trans. Lydia Cochrane (Chicago: University of Chicago Press, 1987); and much of Martin J. S. Rudwick's work, especially *Earth's Deep History: How It Was Discovered and Why It Matters* (Chicago: University of Chicago Press, 2014).

the process of *sourcing* its elemental components from the planetary depths. Querying the materiality of the instrument itself, I consider Italian seismologists' claims that the microphone was comprised of pure bits of untouched elements and offered what they deemed unmediated aural access to a rarified sphere of planetary knowledge. I argue that their mythologization of the idea that they listened *to* the ancient, Vesuvian depths, *through* bits of pure earth reinforced their attempts at asserting Italian environmental authority and modernity post-unification. Relocating the microphone's components to the global markets, supply chains, and modes of racialized labor from which they came, I show that these materials were not untouched bits of earth at all. Instead, Italians likely sourced their materials from global mineral and metallurgical wholesalers. British and Japanese seismologists and mining engineers, who used the device to "divine" the location, stability, and chemical quality of Japan's hissing veins of fossil resources, likely derived their microphonic materials from local mines, factories, and plantations. Much like seismologists, suppliers were equally invested in expanding Western agency over the global environment and capitalizing bodies laboring in the shadow of colonialism and enslavement. The geopolitical, petro-political, ecological, and humanitarian stakes of developing empires and nation-states intervening into earthly sounds resonated in the fibers of the device itself.[9] As sounding instrument and material device, then, seismic microphones both inscribed and embodied what Kathryn Yusoff has called the "Whiteness of geology itself as a material practice [and] regime of material power."[10]

By extending their mechanical ears into the depths of the Earth, seismologists reinforced Western, industrial environmental co-optation that built through the end of the century and created the conditions we now refer to as the *Anthropocene*, a term often attributed to geologist Paul J. Crutzen's trailblazing work of the early 2000s.[11] But the term did not originate with Crutzen and Stoermer. In 1873 some of the earliest theories of the Anthropocene were introduced by Italian geologists, preceding by just five years Italian seismologists' embrace of the microphone. I conclude by probing the coterminous histories of these geological phenomena and asking how their shared intellectual lineage might reshape the ecological and social politics of writing histories of sonic media in our current Anthropocene age. Both then and now, the term *Anthropocene* frames modern world history as driven by a circumscribed category of "the human" (*Anthropos*)—those populations with the requisite technology and civilization to reinvent and lay claim to global environmental space.[12] As I show, this unmarked anthropogenic category—white, Western, and male—was incubated by seismologists who experimented with the microphone as a fantastical means of offering privileged access to earthly sounds. The device, I argue, ultimately asserted a standard of anthropogenic aurality fit for the Anthropozoic era.

The Vesuvian "Earth Machine" and Italy's Metallic Modernity

In the decades preceding the invention of the microphone, earthquake sounds were a source of fascination among both professional scientists and lay-observers. In 1862 British civil engineer Robert Mallet collected accounts of seismic sounds in Italy. Many of these sounds, he warned readers, were mere gossip of unpracticed observers, particularly "lazy Neapolitan savants" who, having spent an inordinate amount of time in a "savage," earthquake-rich zone, were incapable of sensing or describing earthquake sensations.[13] Mallet relied on his own "superior," Northern ears and "unerring certainty of deduction" when it came to assessing the epicentral

[9]On "petropolitics," see Timothy Mitchell, *Carbon Democracy* (London: Verso, 2011).
[10]Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018), 15–16.

[11]Paul J. Crutzen, "The Geology of Mankind," *Nature* 415 (2002): 23. Eugene Stoermer coined the term in the 1980s, but it did not come into regular use until Crutzen revived it.
[12]On the history of the term *Anthropocene*, see Mark Maslin and Simon Lewis, *The Human Planet: How We Created the Anthropocene* (London: Penguin, 2018), 32–35, among many other sources, some of which are cited and discussed toward the end of this article.
[13]Coen, *The Earthquake Observers*, 16.

zone from which these sounds emanated.[14] By 1883 the International Seismological Association explicitly excluded amateur observers in favor of a private network of "gentlemen-naturalists" who owned and crafted their own observational equipment.[15] It was this exclusive contingent of scientists who used their instruments and their practiced resources of observation to respond to the society's stated aim, investigating "what is the earth after all?"[16]

But, both despite and because of Italy's reputation as seismically rich, it was Italian scientists who led many innovations in seismological inquiry, figuring seismic research as a political undertaking with restorative consequences for Italy. In the chaotic wake of the 1783–84 Calabrian earthquakes, the first earthquake commission was established by the Kingdom of Naples to assess the intensity of earthquakes for the safety and security of Neapolitan subjects; in the immediate aftermath of national unification, the Italian Earthquake Commission was established for similar reasons.[17] "The science of endogenous meteorology is the result of recent Italian studies," seismologist Michele de Rossi claimed in 1878.[18] Furthering the efforts of the Italian earthquake commissions, de Rossi—already famous for creating an earthquake intensity scale with Swiss engineer François-Alphonse Forel—likely regarded his seismic endeavors (including inquiries into seismic sound) as a national service, his Italian team of experienced gentlemen-naturalists boasting privileged stewardship of the Earth and predictive insight into its movements.[19]

Following English chemist Farnham Maxwell-Lyte's wild idea of using "a gigantic stethoscope . . . to hear the crackings of the terrestrial crust," in 1878, de Rossi marshalled microphonic listening in service of his political aims.[20] De Rossi's collaborator, volcanologist Giuseppe Mercalli, explained that de Rossi was inspired to build his own microphone "as soon as newspapers brought the discovery of the microphone to us from America."[21] He may also have been influenced by seismologist Giovanni Mocenigo and archaeologist Mariano Armellini who, in 1875, created a device with "all the fundamental principles of the microphone, with a view to its usefulness in his special branch of science, meteorology."[22] Comprised of highly sensitive silver instead of the typical carbon, de Rossi described his device in this way (see plate 1)[23]: "consisting of a balanced pointed lever lightly touching a plate of silver, was mounted on a stone pedestal and was placed twenty meters underground, at a distance from habitations and from roads. It was also thoroughly isolated, and shut up in a box filled with wool."[24] On 3–4 September 1878 at 11:30am and, again, at 3:00am, de Rossi and Mercalli carried this device into a "cavern" within Vesuvius where they listened to the oscillating earth.[25] While Mercalli watched the seismograph, de Rossi listened to and adjusted the microphone, the sounds matching seismographic "intensity values." "While our ears were filled with these noises," he recalled, "there was no sensible motion experienced. Still, it is

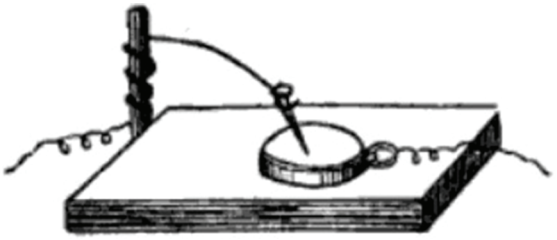

Plate 1: De Rossi's simplified illustration of his microphone (1878). Michele de Rossi, *Il microfono nella meteorologica endogena* (Rome: Tipografia della Pace, 1878), 23.

[14]Ibid., 17.
[15]Ibid.
[16]Ibid., 163–64.
[17]Ibid., 19.
[18]Charles Davison, *The Founders of Seismology* (Cambridge: Cambridge University Press, 1927), 96–97.
[19]Ibid., 97–98.
[20]"Investigating Subterranean Phenomena with the Microphone," *The Engineering and Mining Journal* 27, no. 10 (8 March 1879): 161.
[21]Giuseppe Mercalli, *Vulcani e fenomeni vulcanici in Italia* (Rome: Forni, 1883), 336.
[22]"Volcanic Action and the Microphone," *Pall Mall Budget* 21 (6 December 1878): 19.
[23]George Darwin, "Seismological Innovations in Italy, 1882," *Scientific Papers* 1 (Cambridge: Cambridge University Press, 1907), 435.
[24]"Miscellaneous Intelligence," *American Journal of Science and Art* 103 (1879): 160.
[25]Darwin, "Seismological Innovations in Italy," 435.

evident that the microphone was . . . registering shocks of earthquake otherwise imperceptible" except by the most experienced of observers.[26] De Rossi's sonic experiments attracted such interest that the Prince of Caramanico descended from his nearby villa to assist in de Rossi's microphonic experiments (and, perhaps, to prove that he possessed "unerring certainty of deduction," too).[27]

De Rossi heard beneath Vesuvius what geophysicists now call "free oscillations" that convey information about changes in the structure of the Earth's crust and mantle, and often precede larger seismic events that might strike hundreds of miles away.[28] As nineteenth-century geologists already understood, slow movement within the crust and mantle evinces meteorological events, subterranean heat, and plutonic pressure that form new rock layers and shift and elevate continents. It was the sounds of these meteorological phenomena, otherwise imperceptible to the human ear, that the microphone apprehended. Soon after conducting these studies, de Rossi published the results of his findings in his volcanology journal; his article was widely read, and his methods and findings were described and applauded in many of his international contemporaries' own writings.[29] With these experiments, de Rossi proved to the international seismological community that the idea that the Earth produces sounds of its own accord was not mere gossip or lay-knowledge, as geologists and seismologists had long insisted. He showed that sound was a reliable source of evidence of a microscopic register of tectonic motion, and, most importantly, that the geophysical knowledge it harbored was accessible only to his practiced, Italian ears and specially calibrated, silver microphone.

It is significant that de Rossi chose to press his metallic ears to Vesuvius rather than a more geologically variegated site, such as Sicily's Mount Etna.[30] An active volcano that had erupted with some frequency in the years around 1900, Vesuvius was likely to yield rich information about subterranean movements and change; affirming Vesuvius's usefulness for such matters, when de Rossi began his work in 1878, there were already government-funded meteorological observatories at both Vesuvius and Pompeii.[31] But as a volcano that, in AD 79, had buried in lava two vibrant ancient cities, Vesuvius likely signified a kind of archive of the ancient world, replete with obscure palpitations of the proud Italian past that, as de Rossi's collaborator, meteorologist, and director of the Vesuvius Observatory, Luigi Palmieri, suggested, the microphone might reveal for the first time.[32] De Rossi's decision to pursue novel scientific research at such a high-visibility site—and publicize his findings in his internationally circulated volcanology journal—may have been an attempt to boost Italy's reputation as a modern nation-state post-unification and celebrate the ancient past as an index of a prominent Italian future. For post-unification Italian scientists, the microphonic seemed poised to redress what Deborah Coen has called the "deterministic geography of security and risk" that dominated the international study of planetary physics and geodynamics around 1900.[33] Endowed with exclusive access to the sonic imprint of the ancient Earth and privileged insight into its potentially devastating oscillations, de Rossi presented himself and his Italian collaborators not as "lazy Neapolitan savants," but as scientists in possession of acute instruments and the ability

[26]De Rossi and Mercalli, "Volcanoes and the Microphone," *The American Architect and Building News* 5 (22 February 1879): 63.
[27]Michele de Rossi, *Il microfono nella meteorologica endogena* (Rome: Tipografia della Pace, 1878), 12.
[28]Frank Press, "Resonant Vibrations of the Earth," *Scientific American* 213, no. 5 (Nov. 1965): 28.
[29]See de Rossi, *Il microfono*. De Rossi's study—as well as his collaborators' follow-up studies—was celebrated in French, German, Czech, and English-language scientific publications into the first decade of the twentieth century. See, among other sources, "Le microphone employé comme instrument microsismique," *Annales des Mines* (Paris: Dunod, 1886), 265–67; "A Scientific Invention Wanted," *Scientific American* 37 (4 January 1879): 3; "O Telefonii," *Svêtozor* 19, no. 44 (1884): 704; and "Anwendung des Microphon," *Gaea, Natur, und Leben* 15 (1879): 121.
[30]On nineteenth-century Italian political mythologies of Vesuvius, see Nelson Moe, *The View from Vesuvius: Italian Culture and the Southern Question* (Berkeley: University of California Press, 2002).
[31]T. W. S. Jones, *The Making of a Miracle: The True Story of New Pompeii* (London: Stock, 1907), 127.
[32]"The Voice of the Earthquake," *The Telegraphic Journal and Electrical Review* 7, no. 142 (1 January 1879): 16.
[33]Coen, *The Earthquake Observers*, 104.

to rationally interpret sonic-seismic data.[34] Italy was not a "savage realm" at all, but a modern nation emergent from an ancient empire, invulnerable to environmental hazard and "destined for science and prosperity."[35]

It was quite common in this period for geologists to analogize earthly strata and the circulation of geological matter to the ideal genesis, constitution, and structure of the modern nation-state.[36] De Rossi advanced this epistemological trend, affirming the "modern" nature of his own aural operations—and, by extension, the newly unified Italian nation-state—by representing the seismic report of what was sometimes referred to as Vesuvius's "collection of the different [geological] projectiles of volcanic artillery, bombs and shells, round, elongated, pear-shaped" as a "belliphonic" soundscape of industrial modernity.[37] Below ground, he heard:

> The sound of blowing up a mine underground near the microphone (*esplodare una mina in altro sotterraneo lontano dal luogo ove stave il microfono*), . . . the rising and falling of ticking (*il crescere ed il diminuire del battito dell'orologio*) . . . , ripples, occurring isolated or in musketry volleys, metallic and bell-like sounds, and repeated, metallic detonations, very thick, with sharp, isolated blows (*fremiti, scoppii isolati o di moschetteria, e suoni metallici o di campana, e ripeteva spessissime e successive detonazioni di suono metallico a colpi secchi isolati*). Some of these sounds could be imitated artificially by rubbing together the conducting-wires (*conduttori*) in the same manner in which rocks must rub together during an earthquake, by placing the microphone on a vessel of boiling water, or by placing it on a marble slab and scratching and tapping the underside of it.[38]

De Rossi chose electric metonyms for planetary sounds in a moment of increased electrification across Italy, including in the south and in Naples. But the microphone was not just another electrical device valorized in post-unification Italy. This language reinforces the notion that de Rossi sought to marshal microphonic listening in service of recasting "barbaric" Italy as a technologically modern nation-state, sounds of intratelluric forces transforming into artillery and detonations, the metallic sounds of industry and war. In his accounts of these experiments, Mercalli even referred to this underground world as the Vesuvian "earth machine" (*macchina terrestre*).[39] With his microphonic experiments, de Rossi advanced an audile technique that converted the subterranean into a "field of signs to be heard and interpreted" by the rational, professional ear, a planetary version of the kind of legible transformation of the human body that, as Sterne has shown, the stethoscope facilitated decades earlier. Mercalli made this very connection, referring to the subterranean as "the human organism" (*umano organismo*) and to de Rossi's microphonic seismology as "endogenous auscultation" (*ascoltatore endogeno*).[40] Francesco Protonotari went a step further, describing de Rossi's practice as akin to "pressing a stethoscope to the chest of a patient to feel the most intimate and dark palpitations of disease."[41] Below ground, de Rossi heard electrified, modern post-unification Italy more than he simply heard the "rocks rubbing together," the microphone inducing the dissolution of planetary nature and its unpredictable hazards into the stable, structured circuitry of Italian metallic modernity.[42]

Tuning the Carbon Marketplace

In 1878 it was impossible to standardize scientific instruments like the carbon microphone, as there was no "master instrument" for "field instruments" to materially emulate, to adopt John Tresch's distinction.[43] As such, practitioners built their own devices from an enormous variety of materials in accordance with localized

[34]Ibid., 16.
[35]Ibid., 103, 104.
[36]Gabriel Gohau, *A History of Geology* (New Brunswick: Rutgers University Press, 1990), 111.
[37]Jones, *The Making of a Miracle*, 127.
[38]De Rossi, *Il microfono*, 7–9. Translation adapted from John Milne, *Earthquakes and Other Earth Movements* (New York: D. Appleton & Co., 1891), 323.
[39]Mercalli, *Vulcani e fenomeni vulcanici in Italia*, 336.
[40]Sterne, *The Audible Past*, 95; Mercalli, *Vulcani e fenomeni vulcanici in Italia*, 336.
[41]Francesco Protonotari, "Rassegna Scientifica," *Nuova antologia* 43 (1879): 785 (*È come lo stetoscopio applicato sul petto di un malato per sentirne le più intime e oscure palpitazioni della malattia*).
[42]Mercalli, *Vulcani e fenomeni vulcanici in Italia*, 336.
[43]John Tresch, *The Romantic Machine: Utopian Science and Technology after Napoleon* (Chicago: University of Chicago Press, 2012), 80.

"milieu" and "particular circumstances."[44] For de Rossi, that meant bits of precious metals (silver and copper); for English mathematician George Darwin, pins, copper wire, and shillings.[45] In this section, I heed Jacob Smith's call for media scholars to attend to "the stuff beneath, beyond, and behind the boxes our media come in."[46] I begin by excavating the political charge of de Rossi and his contemporaries' mythologization of his device's materiality and planetary mediality. I go on to ask how those politics are recast when his microphone's material debts to global economic infrastructure, supply chains, and systems of inequitable labor are more fully taken into account. In other words, in this section, I aim to uncover how the political imperatives of de Rossi's endeavors were embedded not just in his use of the microphone, but in the process of sourcing materials to build the device in the first place.

In his writings on his microphonic experiments, De Rossi took great care to describe the material protocols and parameters of his practices. "The microphone rendering in sound the number, form, and every variety of the vibrations of the Earth," he and his team embarked upon a cosmic intellectual undertaking that involved sitting far below ground, surrounded by ancient earth.[47] De Rossi's method seems utterly Romantic: it conjures images of Romantic tales of heroic travelers who, as in Novalis's *Heinrich von Ofterdingen* (1802), heard the rocks emitting "clear, sweet voices" and traveled below ground to pursue their "thirst for knowledge"; or, ancient accounts of pilgrimages to divine, underground sites like the Apollonian oracle at Cumae, not far from Vesuvius.[48] The microphonic voice of Vesuvius seemed sibylline to one of de Rossi's contemporaries, who described his endogenous practices as a form of "ingenious divination" (*ingegnosa divinazione*).[49] Equally enthralled, Darwin claimed that de Rossi conversed directly with the Earth and channeled the "breathing of the solid Earth" flowing through the body of the Earth.[50] Others suggested that he accessed the "voice of the earthquake" or eavesdropped on "the palpitation of the Earth."[51] These adulatory assessments of de Rossi's work and the sounds he revealed reflect the internationalist spirit of seismology around 1900.[52] But they also position him as a privileged, Romantic listener who held uninterrupted, immediate access to the "voice" of nature and its spiritual capital. This elevated status was reinforced by his own descriptions of the pure, elemental materiality of his microphone. It is almost as if by describing an aural device built only of carbon, wool, silver, and copper, de Rossi imagined his privileged communion with the Earth to be unmediated—as if he were listening *to* the "palpitation" of the Earth, *through* pure bits of Earth. In Mercalli's accounts, he refers to both de Rossi and his listening device as an "endogenous listener" (*ascoltatore endogeno*), further collapsing material and psychic distinctions between device, user, and nature itself.[53] Such language reinforced de Rossi's broader scheme to use seismic listening to assert Italian environmental authority and scientific modernity post-unification; after all, there could be no more credible source of predictive geodynamic knowledge than the voice of the ancient soil, whispering directly into de Rossi's privileged, metallic ears.

Largely absent from existing studies of the early microphone is a discussion of the sources of the device's material components: Hughes's carbon microphone was constructed of an electrified bar of carbon granules suspended between metal plates, but where did his materials come from? This perspective might be absent from existing work on the microphone because the

[44]Ibid.
[45]De Rossi, *Il microfono*, 5.
[46]Jacob Smith, *Eco-Sonic Media* (Berkeley: University of California Press, 2015), 14.
[47]De Rossi, *Il microfono*, 18 (*Il microfono rende in suono le vibrazioni telluriche, quali e quante esse sono*). See also Alessandro Malladra, *L'impianto sismico dell'Osservatorio Vesuviano* (Modena: [n.p.], 1914), which contains an image of the Vesuvian grotto where de Rossi's experiments took place.
[48]Novalis, *Heinrich von Ofterdingen*, trans. Ludwig Tieck (Mineola: Dover, 2015), 116, 47.
[49]Protonotari, "Rassegna Scientifica," 785.
[50]Darwin, "Earthquakes," *Littell's Living Age* 57 (1887): 742.
[51]"Voice of the Earthquake," 16.
[52]Coen, *The Earthquake Observers*, 182.
[53]Mercalli, *Vulcani e fenomeni vulcanici in Italia*, 336.

phantasmagoric rhetoric of virtuality and superhuman sensory enhancement that continues to encircle the apparatus inhibits such a mundane focus. But the political investments of de Rossi's microphone can be further exposed when his device's components are deconstructed and relocated within the economic and political infrastructures upon which they relied. Not simply assemblages of untouched elements at all, many of the earliest microphones, including de Rossi's, were likely constructed from materials sourced and sold by a highly developed, international network of scientific suppliers and wholesalers that became increasingly accessible and comprehensive in their offerings around 1900. These suppliers offered samples of individual minerals in "mineralogical pocket laboratories," "self-sufficient traveling laboratories [that] include[ed] tools and implements for sample preparation, fuels, chemicals, and a collapsible analytical balance."[54] Suppliers literally put the planet's precious effluvia and the tools needed to manipulate them into buyers' pockets, collapsing the distance between consumer, planet, and its resources.

Supply networks functioned in compliance with international labor and trade agreements, constantly renegotiated as allegiances, borders, and protectorates shifted; after the First World War, metal, mineral, and chemical sales were strictly regulated by national war commissions.[55] Even though their operations were necessarily linked to politicized bodies and international labor and trade alliances, much like de Rossi, suppliers often left their sources ambiguous—carbon was simply carbon, copper merely copper. The International Acheson Graphite Company, for instance, referred to the "high purity" of their lead, while Western Chemical Manufacturing boasted absolute purity and uniformity of their materials.[56] Eimer & Amend claimed to offer a "complete stock of tested purity, chemically pure, and pure chemicals" that was always on hand.[57] Supply networks were so devoutly "global" and so tethered to the concept of time and space being infinite, pure, and deep that specificity of the point of origin of the materials themselves, the hands involved in deriving them, or even the quantifiable limitations of these resources evaporated into cosmic infinitude, "place" subsumed into "planet." Mineral distributors and seismologists alike thus explicated a historical moment of capitalist expansion during which, in Ursula Heise's words, the planet became as "graspable as one's own local backyard," so much so that the inequitable structures of labor that facilitated such a planetary worldview seemed to disappear.[58]

By incorporating language of elemental purity and earthly infinitude into their advertising, suppliers could be understood as mythologizing the Earth and their access to it, just as de Rossi mythologized his practices with language that almost seems to conjoin his sense organs with the Earth itself. Behind this shared aesthetic vernacular, however, lay an ethos of environmental domination, extraction, and possession of the unproductive Earth that, in the case of suppliers, took concrete form in global economic infrastructure. Scientific actors and suppliers touted their allegedly unmediated communion with the Earth as a sign of their authority over it, animating what Frantz Fanon has called the "exclusive humanism" that underwrote nineteenth-century language that blurred "Nature" and the "human."[59] But these actors also implicitly blurred the material border of "Nature" and the bodies of unseen, subterranean laborers, allowing the infinite Earth to subsume those who plumbed its depths on the behalf of industrial humanity.[60] Where enhanced environmental mediality inaugurated scientific actors' membership in the "exclusive club [of] the human species," as Yusoff and Fanon explain, a similar set of more implicit material assertions

[54]Ulrich Burchard, "Blowpipe," in *Instruments of Science: An Historical Encyclopedia*, ed. Robert Bud (London: Taylor & Francis, 1998), 69.
[55]"Regulations Concerning Exports to Great Britain, Italy, and Belgium," *Metallurgical & Chemical Engineering* 18 (1918): 594.
[56]*Dictionary of Metallurgical and Chemical Material* (New York: Electrochemical Publishing Company, 1910), 128.
[57]Ibid., 27.
[58]Ursula Heise, *Sense of Place, Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008), 4.
[59]Frantz Fanon, *The Wretched of the Earth*, trans. Richard Philcox (New York: Grove, 1965), liv.
[60]Yusoff, *A Billion Black Anthropocenes or None*.

transformed invisible laborers into inhuman, "inert matter," bonding their racialized subjectivity to their nonagentic materiality.[61] As de Rossi and his contemporaries claimed the microphone apprehended the "voice" of the Earth transmitted through pure bits of Earth, they were really listening to and through resonant, material traces of an industrial marketplace, overseen by Western economic and political powers committed to turbo-powering the depths and, along the way, capitalizing "inert," nonagentic laboring bodies. De Rossi's microphone thus bore a cosmic "thickness," as it materially embodied the kind of global oversight, environmental intervention, and idealized human agency to which the earliest seismologists and their suppliers aspired.

Seismic Mining in Tokyo

In the decades following de Rossi's pioneering work, seismologists replicated his practices, seeking to use the microphone to cultivate knowledge of the global subterranean. In this section, I explore the role of the microphone within the aural endeavors of British and Japanese seismologists, whose scientific collaborations served the mutual economic and military interests of their empires, informally allied in the wake of Japan's renegotiation of its unequal treaties in the 1870s.[62] For British and Japanese seismologists alike, of particular attraction was the microphone's ability to "divine" the location, stability, and quality of seams of coal, a process that inextricably bound the pursuit of "exact knowledge" to the "exercise of power."[63] I go on to show that by tracing users' microphonic materials to local manufacturing, ecologies, and exploitative labor practices it becomes possible to examine the intertwined strands of that "Gordian knot" of knowledge and power, revealing with some specificity the human and ecological toll of Japanese and British treatment of the microphone as a form of "divination media."[64]

As the old feudal system was replaced with a new imperial order, Japan's Meiji era (ca. 1868–1912) witnessed widespread Japanese embrace of Western technologies and social and economic systems, as the Meiji government pursued national excellence—often modeled after British standards—and the unassailable, global strength of ancient and modern empires.[65] The time was right for the birth of Japanese instrumental seismology. Having deeply engaged de Rossi's work, Japanese geographer Shiga Shigetaka claimed in his *Nihon fūkeiron* (1894) that Western civilization began in Italy's volcanic peninsula.[66] It was only logical, he argued, for Japanese seismology—primarily concerned with the development of earthquake-safe architecture, a metaphor for the strength of the nation—to be modeled after Italian procedures.[67] Seeking to establish a distinctly Japanese brand of seismology, the president of the Japanese Imperial Earthquake Investigation Committee, Fusakichi Ōmori, adapted the Rossi-Forel scale from Italian to Japanese specifications: the new scale accounted for wooden instead of stone structures and completely removed reliance on "felt" accounts of earthquake intensity to establish the total credibility of their data.[68] This privileging of "instrumental" over "human seismographs" was an effort to brand Japanese society—sitting atop an island that, like southern Italy, was famous for its seismicity—as "destined for science and prosperity" and invulnerable to seismic hazard, powerful metrics of modernity, stability, industry, and technological development in a moment when Japan sought recognition as a global power.[69]

[61]Yusoff, *A Billion Black Anthropocenes or None*; Fanon, *The Wretched of the Earth*, liv. On the violent, colonialist implications of blurring the human/nonhuman, see also Sarah Ives, "'More-than-Human' and 'Less-than-Human': Race, Botany, and the Challenge of Multispecies Ethnography," *Catalyst: Feminism, Theory, Technoscience* 5, no. 2 (2019): 1–5.
[62]Gregory K. Clancey, *Earthquake Nation: The Cultural Politics of Japanese Seismicity, 1868–1930* (Berkeley: University of California Press, 2006), 5.
[63]Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993), 3.
[64]Ibid. Smith, *Eco-Sonic Media*, 80.
[65]Clancey, *Earthquake Nation*, 106–07.
[66]Ibid. See Shigetaka, *Nihon fūkeiron* (Tokyo: Bunbudo, Meiji, 1894).
[67]Clancey, *Earthquake Nation*, 106–07.
[68]Ibid., 156.
[69]Coen, *The Earthquake Observers*, 279, 104.

Japanese seismologists often negotiated the production of earthquake knowledge with British engineers, who joined the staff of Japanese technical colleges in droves (a common method for imperial powers to assert authority over other nation-states).[70] Collaboration was often led by the founder of Anglo-Japanese seismology, British mining engineer John Milne, who invented the first seismographs sensitive enough to "trace the development of earthquake waves over time" and, influenced by de Rossi, introduced the microphone to Japan-based seismic research in 1903.[71] A professor of geology and mining at Tokyo's Imperial College of Engineering, Milne incorporated microphonic data into a vast array of projects that served Japanese, British, and broader Eurasian economic, military, and scientific interests. These included using the device to approximate and confirm the location, stability, and quality of underground fossil resources; track the movement of earth tremors and severity of global "seismic storms" (data that informed his seismographic world map); assess the soundness of mining structures and presence of combustible "fire-damp" (coalbed methane) in mining shafts; and attenuate the unpredictability of Japanese weather.[72]

For many seismologists, including Milne, earthquake management was a form of resource management that the microphone could support. The device explicitly served the global energy transition from wood to coal that underwrote Western pursuit of Anthropocenic, environmental conquest and the attendant capitalization of what Rob Nixon has referred to as "disposable people" and "disposable ecosystems."[73] For example, French physicist Théodose du Moncel claimed that the microphone was useful for tracing seams of coal imperceptible to other seismographic instruments, as almost inaudible sounds were produced when seams of coal opened below ground; Milne agreed, noting in his *Miner's Handbook* (1902) that an imperceptible hissing sound was released as coal seams form.[74] Reconciling the existence of earthquakes with the fantasy that nature was "destined . . . to bear wealth for white settlers," British geologist Thomas Rowlandson claimed in the 1870s that the earthquakes that shook the British empire as it spread across the globe were a "cosmical agent employed by the greatest designer of them all for contribution to his final aims"—white settlers' extraction of precious metals and capitalization of "inert," "disposable people," including across the Japanese empire.[75]

The specific geopolitical, ecological, and humanitarian stakes of Milne's microphonic investigations into the seismicity of fossil fuels can be read into the material coordinates of his device, likely built from the effluvia of local mines and plantations, sourced by the hands of indigenous, dispossessed, and/or impoverished Japanese workers. He described the idiosyncratic materiality of his microphone in one of his many treatises on the seismicity of Japan: "The microphones were small, doubly pointed pencils of carbon about three centimetres long. . . . They were covered with a glass shade thickly greased at its base. The stakes were in the ground at the bottom of a small pit. . . . The wires from the microphone passed through the side of the box into a bamboo tube and thence up to my dining-room and bedroom."[76] Milne's ability to craft this microphone—a tool for the "divination" of fossil resources—relied not only on global industrial supply chains (as did de Rossi), but on local economic networks, markets, and racialized systems of labor that expanded as Japan pursued economic modernization and viability on the world stage, a process that was hastened by Western actors like Milne.

[70]Lewis Pyenson, *Cultural Imperialism and Exact Sciences: German Expansion Overseas, 1900–1930* (New York: Peter Lang, 1985), 35; Coen, *The Earthquake Observers*, 17.
[71]Coen, *The Earthquake Observers*, 19.
[72]Milne, *Earthquakes and Other Earth Movements*, 222; Milne, "Seismology and Colliery Explosions," *Supplement to the Mining Journal, Railway, and Commercial Gazette* 54, no. 2532 (1 March 1884): 262; Darwin, "Seismological Innovations in Italy," 437.
[73]Rob Nixon, *Slow Violence of the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2007), 4. On the global energy transition in the decades around 1900, see Vaclav Smil, *Energy and Civilization* (Cambridge, MA: MIT Press, 2017), 395.
[74]Count du Moncel, *The Telephone, the Microphone, and the Phonograph* (New York: Harper & Brothers, 1879), 182–83; John Milne, *Miner's Handbook* (London: Lockwood, 1902), 160.
[75]Coen, *The Earthquake Observers*, 194 (emphasis Rowlandson's); Nixon, *Slow Violence*, 4.
[76]Milne, *Earthquakes and Other Earth Movements*, 318.

Milne includes a few material referents in his description of his microphone that both recall the political context of its development as a tool for serving Asiatic-British economic collaboration and register the humanitarian and ecological toll of his project. Milne lists "grease," a significant Japanese export; "glass," a Western invention altered considerably by Japanese manufacturers; and "bamboo," an endemic and emblematic Japanese product. "Plant grease," or Japan wax, was a major export and locally traded product made by drying and melting sumac berries, an arduous process undertaken on government plantations in Japan and Hawaii. Sumac trees took at least seven years to mature and could only be harvested with heavy, wooden flails, one or two laborers to a tree, on the hottest days of the year.[77] Conditions on these plantations were harsh, and workers—some of whom were indigenous Ainu and Ezo men, women, and children, displaced from their ancestral lands by imperial plantations—often perished from heat stroke, dehydration, or violent crime.[78] As for the bamboo: thirty-nine species of bamboo were endemic to Japan, and the crop had long been emblematic of Japanese culture in the West. Some varieties were exported to Europe, and Japanese growers entered into contracts with villages to employ Ainu and Ezo peoples, who grew some varieties of bamboo to eat.[79] Growers were struggling with mosquito infestations and damaging, moldy "smut" (prevalent in Japanese bamboo), which had infiltrated their wet forests of bamboo, making it more difficult to harvest and sell.[80] Many farmers were afraid of this dangerous plague spreading from the bamboo to their own lungs, though it probably disproportionately affected laborers.[81] Glass was introduced to Japan by German travelers, who brought what Clive Holland, writing on "The Art and Art Instincts of the Japanese Race" in 1907, called "glasses of civilisation" (or, beer glasses) to Japan.[82] Apparently complaining that imported glass was low-visibility, Japanese *daiku* craftsmen and factory workers (working under German glass artisans and engineers, including German-British engineer and businessman Carl Wilhelm Siemens) developed clearer glass that they exported to Europe.[83] The "carbon pencils" may have been imported from a global supplier or from Japanese coal mines, their "lumps" extracted by poverty-stricken male and female miners, who were often exploited by European contractors, beset by violent union disputes, and terrorized by "bandits."[84] Monopolized by European markets, Japanese coal dominated 50 percent of the global coal market by 1900 and rose steeply in value, causing a "coal famine" in Asia; it is unlikely that Milne sourced his carbon locally at this time, though he may have circuitously obtained it from British markets.[85]

Traces of the global material networks, ecologies, and modes of racialized labor upon which Milne's project relied vibrated beneath his lawn. As microphones provided British and Japanese seismologists another means to expand their base of fossil fuels and broaden their knowledge of earthly geodynamics, the instrument physically embodied those same globalizing impulses, borne out upon subaltern bodies that both provided seismologists their materials and were most violently impacted by the imperialist and capitalist logics that authorized their practices.

[77]"Japan Wax," *Official Guide to the Museums of Economic Botany* 1 (London: Eyre & Spottiswoode, 1886), 40.
[78]*Hawaiian Planters' Monthly* 4 (1885): 148; Mark K. Watson, *Japan's Ainu Minority in Tokyo: Diasporic Indigeneity and Urban Politics* (London: Taylor & Francis, 2014).
[79]Shin'ichirō Takakura, *The Ainu of Northern Japan: A Study in Conquest and Acculturation* (New York: American Philosophical Society, 1960), 33.
[80]"A Bamboo Disease," *Tropical Agriculturalist* 29 (London: Ferguson, 1907): 204.
[81]Ibid.
[82]Clive Holland, *Old and New Japan* (London: Dent, 1907), 226–27.
[83]Martha Chaiklin, "A Miracle of Industry: The Struggle to Produce Sheet Glass in Modernizing Japan," in *Building a Modern Japan: Science, Technology, and Medicine in the Meiji Era and Beyond*, ed. Morris Low (New York: Palgrave Macmillan, 2005), 179.
[84]Tim Wright, *Coal Mining in China's Economy and Society, 1895–1937* (Cambridge: Cambridge University Press, 1937), 100, 183.
[85]Terence Hall, "Coal-Mine Accidents, 1901–1910" (Washington: [n.p.], 1913): 79; Wright, *Coal Mining in China's Economy and Society*, 100; Smil, *Energy and Civilization*, 395.

Conclusions—Microphonic Anthropocenes

The 1870s were monumental for geologists and seismologists. Not only did de Rossi begin using the microphone to apprehend a new class of geophysical knowledge, but, in 1873, Milanese geologist Antonio Stoppani popularized the term "Anthropozoic era," a precursor to today's Anthropocene.[86] By way of conclusion, I want to query the intellectual and political impulses that united the development of a geological term for this new geospatial epoch and the use of the microphone to eavesdrop on the Earth in the 1870s, and to consider how exposing their shared conditions of possibility might reshape the racial and ecological politics of writing histories of aural media technologies in our (current) Anthropocene age.

In some ways, the coevolution of "tectonic microphonics" and the "Anthropozoic era" is not so surprising. By using the microphone to amplify the stature of modern, industrial humanity in environmental space, seismologists cultivated the socio-racial and political impulses associated with the idea of the Anthropocene from the concept's invention. Writing on the Anthropozoic era in his *First Period of the Anthropozoic Era* (1873), Stoppani celebrated the "true progress of humanity" marked by "[substitution] of ancient slavery with freedom, darkness with light, fall and degeneration with rebirth. . . . [This] new element [humanity] . . . that for its strength and universality does not pale in the face of the greatest forces of the globe."[87] He pointed to industrializing Europe as exemplifying "man [having pushed] his dominion most forward and where, although recent, his footprints are the deepest. . . . We are talking about European man, because Europe, more than other regions, feels man's sovereignty. Home to ancient civilizations, occupied by powerful nations."[88] Though he refers, here, to Europe as a monolith, Stoppani harbored a patriotic agenda: he had spirited aerostats bearing revolutionary missives across the barricades during the 1848 *Cinque giornate di Milano*, and he identified Italy as "the synthesis of the physical world" and rightful home of geology.[89] Writing in the shadow of Italian unification, Stoppani's treatise implicitly repositioned newly unified Italy—undoubtedly "home to ancient civilizations, occupied by [a] powerful nation"—within the sphere of European modernity. He portrayed Italians not as "barbaric," "lazy Neapolitan savants," but as the "new element [and] telluric force" that exemplified a monolithic *Anthropos* or "humanity."[90] They were part of that "exclusive club [of] the human species" that possessed the requisite forms of technology, civilization, and environmental agency to initiate the conditions of an era named, then and now, for them.[91]

The microphone not only supported the dynamic spread of industrial populations (including Italian, British, and Japanese actors) within and across the globe, but rendered audible a new sonic signature of the subterranean, inseparable from the device itself and the conditions of its production and use. Just as Stoppani identified industrial, European humanity (and Italians, in particular) as exclusively qualifying as *Anthropos* in his Anthropozoic era, many seismologists held that the resonant rocks did not speak to just anyone. While they eventually understood earthquake sounds as falling "below the range of audibility of some people" because the vibrations were so low, access to these sounds was initially sharply racialized and gendered.[92] Despite his regular collaboration with Japanese scientists, Milne's Scottish colleague Cargill Gilston Knott argued the "Japanese as a people are defective in the power of hearing low sounds," while Mercalli claimed that women were too "sensitive" and "nervous" to hear earthquake sounds.[93] The microphone appeared to enforce a threshold not just of professional,

[86]Maslin and Lewis, *The Human Planet*, 32–34.
[87]Antonio Stoppani, "First Period of the Anthropozoic Era," in *Making the Geologic Now: Responses to Material Conditions of Contemporary Life*, ed. Reg Beatty, Elizabeth Ellsworth, and Jamie Kruse (Brooklyn: Punctum Books, 2013), 36; Maslin and Lewis, *The Human Planet*, 32–34.
[88]Stoppani, "First Period of the Anthropozoic Era," 36–39.
[89]Beatty, *Making the Geologic Now*, 35.
[90]Coen, *The Earthquake Observers*, 16; Stoppani, "First Period of the Anthropozoic Era," 36–39.
[91]Fanon, *The Wretched of the Earth*, liv.
[92]Coen, *The Earthquake Observers*, 222.
[93]Cargill Knott, *The Physics of Earthquake Phenomena* (Oxford: Clarendon, 1908), 13; Coen, *The Earthquake Observers*, 93.

rational, or scientific hearing (as Sterne implies), but of *human* hearing—inflected as male, white, Western, industrial, and modern, the very demographic of Stoppani's *Anthropos*.[94] Extending Mara Mills's assertion that the first hearing aids affirmed standards of aural normalcy, if one was not able to credibly and reliably perceive the full range of the sounds of the Earth—women, Japanese listeners, "lazy Neapolitan savants"—then perhaps one was not really human.[95] This was an anthropogenic aural standard fit for the Anthropozoic era.

Kyle Devine has suggested that producers and consumers of media technologies have contributed only "indirectly" to "legacies of [environmental] inequality, dominion, and extraction."[96] Similarly, Dipesh Chakrabarty has argued that humans have borne only an accidental "geological agency."[97] Jeremy Davies, Donna Haraway, and their interlocutors have suggested that the term *Anthropocene* encourages these kinds of narratives: the term itself fails to identify those populations that—both in Stoppani's day and ours—most actively fostered anthropogenic climate crisis or exposed their intentionality in doing so. Treating the planetary conditions of climate change as a universal, accidental "species" failure, instead of as a set of specific historical conjunctures perpetuated by a smaller subset, obscures important, long-standing differences in human responsibility as well as climate-related injustices. But, as the Anthropocene was inaugurated (and "tectonic microphonics" popularized), such obfuscation *was* intentional: the term itself monumentalized a circumscribed idea of the "human," limited to those who enjoyed heightened access to the planet's deep resources, including its sonic signs and signals. As Devine aims to position aural media within a reading of catastrophic environmental change as an accidental "species" failure, he inadvertently directs media histories away from the pressing social and ecological problems of the climate crisis that have arisen from the entwined logics of racial capitalism and environmental modernization that initiated Anthropocenic thinking in the late nineteenth century.

The earliest seismologists did not bear accidental "geological agency."[98] Instead, they actively, intentionally, even gleefully pursued membership within a circumscribed *Anthropos* by using the microphone to cultivate the Anthropocene's "inequitable global processes," from fossil resource extraction to the aural discrimination of the racialized "other." Seismologists' sonic endeavors thus exemplify broader aesthetic, political, and ecological currents that, even in our age of digital media, continue to bind histories of sonic media and aurality to histories of Anthropocenic logics of racialized power and privilege, fossil capital, and the climate crisis.

The Anthropocenic character of these material and intellectual histories of sound could be understood as redoubled within the Anthropocenic act of writing them. Scholarly labor practices—from typing articles on energy-hungry devices crafted from extracted minerals derived from the earth by poorly treated workers to streaming music from data centers bearing immense carbon footprints—could quite easily be understood as Anthropocenic, as we scholars both benefit from and deepen the endemic historical environmental and humanitarian injustices this article has outlined. As Jim Sykes has argued, we are more generally "living our academic lives through mid-twentieth-century disciplinary divides that embed much older European-derived ideas that . . . helped produce and legitimize what Clive Hamilton describes as 'active human interference in the processes that govern the geological evolution of the planet,'" which include remnants of colonial encounters and extractive ecologies of capitalism that our labor practices and devices invisibly perpetuate.[99] As Sykes points out (and as this article has shown), at times, the scholarship

[94]Sterne, *The Audible Past*, 95.
[95]Mara Mills, "Hearing Aids and the History of Electronic Miniaturization" in *The Sound Studies Reader*, ed. Sterne (London: Routledge, 2012), 75.
[96]Kyle Devine, *Decomposed: The Political Ecology of Music* (Cambridge, MA: MIT Press, 2019), 26, 48–49, 147.
[97]Dipesh Chakrabarty, "The Climate of History," *Critical Inquiry* 35, no. 2 (2009): 206.
[98]Ibid.
[99]Jim Sykes, "The Anthropocene and Music Studies," *Ethnomusicology Review* 22, no. 1 (2020): 1, 5.

that emerges from and relies upon our ever-Anthropocenic technologies and practices upholds a "Romantic aesthetic [that] thoroughly separate[s] musical meaning from seemingly worldly affairs" and the "maintenance of the Earth system."[100] This article has examined that Romantic separation as it pertains to the early history of the microphone, the ethics of its extracted materialities, and the politics of its use—and it aims to show that this false separation can, ultimately, be lodged in the historicity of the concept of the Anthropocene whose lived realities remain inescapable today.

Abstract.
"Tectonic Microphonics" explores the politics of seismologists' use of the microphone to listen to the deep, elusive sounds of the Earth in the years around 1900. It argues that seismological representatives of three emerging nation-states and empires—Italy, Japan, and Britain—used the microphone to lay claim to elusive geophysical data, encrypted in fleeting, earthly sounds. It suggests that seismologists' enhanced knowledge of the subterranean movements of the Earth, a purported consequence of their microphonic aurality, represented a form of geopolitical currency. Such powers of prediction were viewed as an important index of national security and scientific development: the microphone thus represented an opportunity for occupants of seismic geographies (like Italy and Japan) to overcome what Deborah Coen has referred to as the "deterministic geography of security and risk" that, for some geologists, reduced them to the status of "barbarians." At the same time, this article demonstrates that valorizing the civilizing consequences of this form of technologically mediated aurality relied upon extractive ecologies of capitalism and exploitative human labor that were often obscured by scientific users and their global networks of collaborators and enablers. As the article's concluding section shows, these activities came on the heels of the birth of one of the earliest ideas of the Anthropocene, circulated in the writings of an Italian geologist as a term for the agency of white, European, "steam-powered" men (a circumscribed *Anthropos*) over the Earth, its fossil resources, and its less-than-human laborers. This article concludes by arguing that the microphone established a standard of anthropogenic aurality fit for the birth of the age of the Anthropocene. Keywords: Romantic, geology, aurality, Anthropocene, sound studies, technologies

[100]Ibid., 14, 15.