Scientific and Cultural Interpretations of Volcanoes, 1766-1901

by

Kent Robert Linthicum

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Graduate Supervisory Committee:

Mark Lussier, Chair
Daniel Bivona
Devoney Looser
Marlene Tromp

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ABSTRACT

Scientific and Cultural Interpretations of Volcanoes, 1766-1901 analyzes nineteenth-century conceptions of volcanoes through interdisciplinary literature and science studies. The project considers how people in the nineteenth century used science, aesthetics, and other ways of knowing to understand volcanoes and their operations. In the mid-eighteenth century, volcanoes were seen as singular, unique features of the planet that lacked temporal and terrestrial reach. By the end of the nineteenth century, volcanoes were seen as networked, environmental phenomena that stretched through geological time and geographic space. *Scientific and Cultural Interpretations of Volcanoes, 1766-1901* offers a new historical understanding of volcanoes and their environmental connections, using literature and science to show how perceptions of volcanic time and space changed over 135 years.

The first chapter, using texts by Sir William Hamilton, Hester Piozzi, and Priscilla Wakefield, argues that in the late eighteenth century important aspects of volcanoes, like their impact upon human life and their existence through time, were beginning to be defined in texts ranging from the scientific to the educational. The second chapter focuses on works by Sir Edward Bulwer-Lytton and Charles Lyell to demonstrate the ways that volcanoes were stripped of metaphysical or symbolic meaning as the nineteenth century progressed. The third chapter contrasts the 1883 eruption of Krakatoa with Constance Gordon-Cumming's travels to Kīlauea. The chapter shows how even towards the end of the century, trying to connect human minds with the process of volcanic phenomenon

was a substantial challenge, but that volcanoes like Kīlauea allowed for new conceptions of volcanic action. The last chapter, through a post-apocalyptic novel by M. P. Shiel, shows how volcanoes were finally beginning to be categorized as a primary agent within the environment, shaping all life including humanity. Ultimately, I argue that the change in thinking about volcanoes parallels today's shift in thinking about global climate change. My work provides insight into how we imagine ecological catastrophes like volcanic eruptions or climate change in the past and present and what that means for their impact on people.

For my father, Larry Linthicum (1947-2012)

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INTRODUCTION

The poem “Image in Lava” (1828) by Felicia Hemans (1793-1835) addresses the impression of a woman and her child in volcanic ash found in Herculaneum. Hemans’ poem paints a tragic yet loving picture as the mother fleeing from the pyroclastic flows decided that it was “Far better then to perish, / Thy form within its clasp, / Than live and lose thee, precious one!” (Hemans 29-31). For the mother in the poem dying with her child in these circumstances is preferable to living without them. Hemans ends the poem by saying that “human love” has given the ash impression a divine glow which she reinforces by saying “It must, it *must* be so!” (Hemans 44). The impression in ash does not glow because of latent heat, but as a result of human emotion. The poem evokes both suffering and love, finding a sliver of brightness in a horrifying catastrophe. Noticeably absent from Hemans’ poem is Vesuvius itself. Vesuvius, perhaps the most well-known volcano in human history, caused the destruction of both Herculaneum and Pompeii in 79 CE. Yet Hemans does not mention the volcano, only the pyroclastic flow: “When suddenly the fiery tomb / Shut round each gentle guest?” (Hemans 15-16). Hemans’ poem is an excellent example of the status of volcanoes in early nineteenth-century culture: just outside the frame. Volcanoes both destroy and benefit human life throughout history, yet they are often not visible until they erupt. In the eighteenth and nineteenth centuries writers made volcanoes more visible examining geologic time, and the impact that volcanoes had upon the environment.

Historically, volcanoes have been canvases for humanity to interpret, symbols for human choices or values, rather than environmental phenomena that exist and change

under their own laws. Early references to volcanoes in English focus on the mountains as the homes of gods, giants, or devils. In Old English, references to Vulcan occur in phrases like “Fýres god, helle smiþ Vulcanus” [The god of fire, smith of hell Vulcan] (Bosworth). Rather than naming volcanoes as a specific feature of world, they were instead the forge of Vulcan or the mouth of Hades. In Middle English the word starts to take on some of its modern meaning, with the word ‘vlcane’ appearing in 1387. Vlcane is used to refer to the Aeolian Islands (“vulcan(e, n”) north of Sicily, which are home to the volcanoes of Stromboli and Vulcano. The entry from John of Trevisa’s 1387 translation of Ranulf Higden’s *Polychronicon*, mentions that there is always fire being emitted from the island (“vulcan(e, n”) a reference to Stromboli’s frequent eruptions (“Stromboli”). As the *Oxford English Dictionary* notes, volcano does not enter the language until the fifteenth century from Italian (“volcano, n.”). The Italian word came from Latin, and the name for the Roman god of the forge, Vulcan (“Vulcan, n. and adj.”). Part of the reason that volcano does not enter the language earlier is because a systematic category was not important: there were only three to four fiery mountains in the world, that list consisting of some combination of Etna, Vulcano, Vesuvius, Hekla, and Stromboli.

In the middle of the eighteenth century, volcanoes were seemingly on the border of civilization: unique mountains that would smoke, shoot fire, and explode. Vesuvius in Naples, Etna in Sicily, and Hekla in Iceland were all on the edge of Europe. They were recognized geographic features, but appeared to have little impact except on Neapolitans, Sicilians, and Icelanders. No Europeans knew about the two most important volcanoes of the nineteenth century, Tambora and Krakatoa, yet. Despite a lack of systematic

recognition by English-speaking people, volcanoes did have an impact upon English speakers. Volcanoes in the early nineteenth century reshaped parts of British culture, which is surprising given that there are no active volcanoes in Britain (there are a few extinct ones though, like Castle Rock in Edinburgh, or Arthur's Seat). The actual effects of volcanoes often passed unobserved. Culture reshaped perceptions of volcanoes more than eruptions. In the eighteenth and the nineteenth centuries exploration, tourism, colonization, science, and literature were introducing new volcanoes into culture.

Descriptions of far-flung volcanoes in the Americas, new scientific treatises on volcanism, sensational volcano dramas with pyrotechnic displays, the excavation of ruins buried in volcanic ash, and novels of explosive volcanism saturated culture. The word volcano, as the *Oxford English Dictionary* records, even became a noun used to refer to "something which or someone who bursts out, or is liable to burst out, unpredictably into violent or dangerous activity" ("volcano, n.") and the word even became a verb later in the nineteenth century ("volcano, v."). Volcanoes were so popular Lord Byron complained about them in *Don Juan* saying "I hate to hunt down a tired metaphor, / So let the often-used Volcano go" (Byron 13.36.285-86). Byron's quip shows that volcanoes were used so frequently that they were becoming meaningless as a metaphor. While the over-usage of volcanic imagery in culture annoyed Byron, it also shows how popular volcanoes were. Between 1766 and 1901, thanks to volcanic fascination in culture volcanoes were slowly starting to be viewed as environmental phenomena and not as human symbols as they had been historically. Over the course of the eighteenth and nineteenth centuries, a diverse group of writers and thinkers developed better

understandings of the mechanisms of the volcanoes and their mode of being. The work of these writers helped link both culture and volcanoes in an environmental network.

Volcanoes in the eighteenth and nineteenth centuries are important to the twenty-first century, because human civilization has more similarities to volcanoes now as a result of anthropogenic global climate change. Both volcanoes and human societies are notable for their abilities to alter the earth's climate. The ability to affect climate means that volcanoes are of special interest in what a variety of scholars have been calling the Anthropocene: a new geologic epoch defined by humans having an impact upon the environment. Lewis and Maslin explain that the rationale for the naming of the Anthropocene is that "The impacts of human activity will probably be observable in the geological stratigraphic record for millions of years into the future, which suggests that a new epoch has begun" (Lewis and Maslin 171). Due to a variety of factors, largely focused on industrialization and the exploitation of fossil fuels, the claim is that humanity has an impact on the level with geologic phenomena like volcanoes. Recently, Waters et al. have argued exactly that using a range of evidence including sediment and ice cores to show that the Anthropocene is a distinct unit of geologic time (Waters et al. 141-44). Thus human societies have joined an elite club with volcanoes, as volcanic eruptions have been used to demarcate a variety of stratigraphic lines and geologic epochs.

The dramatic and catastrophic effects of volcanic climate change offer a window into what the result of anthropogenic climate change might be. For example, between the Permian (298.9–252.17 million years ago) and Triassic (252.17–201.3 million years ago) periods the earth experienced the largest mass extinction event in its history. During that

time “95% of shell-bearing marine species and 80% of land animals perished” (Ogden and Sleep 59). Many theories offer explanations for why so many organisms died off. Ogden and Sleep argue the answer is the eruption of the Siberian Traps, a large igneous province in Russia. The eruption of the Siberian Traps, in conjunction with the burning of a vast coal field, radically altered the earth’s atmosphere causing the mass extinction (Ogden and Sleep 59). Volcanoes have been connected with the Triassic–Jurassic extinction event (Blackburn et al. 941) and considered a factor in the Ordovician–Silurian extinction events **(**Harper, Hammarlund, and Rasmussen 1300**)** and have even been causally linked with every major mass extinction in earth’s history (Courtillot and Renne 131). Humanity has yet to cause ninety percent of life on the planet to go extinct, but all evidence suggests that the demarcation of the Anthropocene is certainly merited now and will be in the future thanks to climate change. Unlike volcanic climate change, anthropogenic climate change might be reduced or blunted. Understanding the dimensions of climate change is one of the key factors in affecting it. The eighteenth and the nineteenth centuries have an analogue in the understanding of volcanoes, and by looking at the way thinking about volcanoes developed, parallels can be drawn to modern thinking about climate change.

Climate Change or global warming is of importance at this moment in human history. Many scholars and scientists are working hard towards understanding the various human causes of climate change, ways to mitigate the effects of climate change, and adapt to a new environment. Volcanoes have a similar impact upon the earth’s environment as human beings do. The ash clouds emitted in some eruptions, which can

encircle the globe, dramatically alter the climate by reflecting a small percentage of the sun's light. Volcanoes and reactions to volcanic eruptions should be an object of study because they provide data on climate change and human reactions over longer periods of time. Gillen D'Arcy Wood's book *Tambora* (2013) investigates the question of human reaction to climatic changes caused by volcanoes by considering the impact of the 1815 eruption of Mount Tambora. Wood frames his work by saying that "haywire story of a two-centuries-old global climate crisis may at last be properly told and with it our own fate, in cautionary ways, foretold" (G. Wood 11). The parallel which Wood draws is that human responses to a climate crisis in the nineteenth century can give insight into what kinds of crises humanity will face in the twenty-first century and beyond.

Given that volcanoes give a glimpse at what can occur during radical climate change, mass extinctions for example, one would think that human societies would be working, cooperatively, to avert the potential for an environmental collapse that would imperil human survival. The political debates around climate change at the end of the twentieth and the beginning of the twenty-first centuries show the opposite. One reason for these debates is because climate change is difficult to comprehend. In part because of size and in part because of time, climate change is easy to misunderstand. As Robert Markley points out "climate change invariably poses questions about time or, more precisely, different registers of time: experiential or embodied time, historical time, and climatological time" (Markley 43). Climate change operates at a different rate of time, which makes it difficult to grasp and means that shorter, human time frames are easier to follow. To understand climate change people need to change the ways that they look at

the world and its systems, and think beyond the human frame of reference. Volcanoes are one of the few objects on the planet that can cause rapid climate change. Thus Wood argues that understanding their impact is important. But considering the ways that human cultures understand volcanoes as a set of geologic systems and mechanics is likewise important. Investigating how the understanding of volcanoes has changed over eighteenth and nineteenth centuries can provide insight into how climate change is understood today, as both objects operate over a space and time that can be difficult for human beings to grasp.

This dissertation will examine the historical understanding of volcanoes between 1766 and 1901 to show how people considered massive, climate changing objects like volcanoes.[1] Through literary and cultural texts, this dissertation will show how volcanoes became viewed as part of the earth's systems, especially through representations of deep time and the removal of symbolic meaning from volcanoes. The late eighteenth and nineteenth centuries saw some of the more spectacular volcanic eruptions in recorded human history. Scientific knowledge and globalization were also more fully developed in those periods. Understanding volcanoes is not merely a matter of looking into the scientific records: volcanoes were physical objects and also metaphoric objects of human culture. To fully examine volcanoes they need to be seen through multiple lenses, especially to address the ways that volcanoes are fundamentally different, alien to human

[1] Susan Sivard's dissertation, *Upheaval and Transformation: The Volcano in American and European Art, 1765-1865* (2011), also thoroughly engages with nineteenth-century volcanoes. She argues persuasively for a multifaceted, metaphoric understanding of volcanoes between 1765 and 1865. The dissertation here, while similar in content, is distinct in trajectory: whereas Sivard shows how volcanoes were used as symbols, this dissertation will show how at the same time volcanoes were also starting to be seen as environmental.

minds. Recent philosophical and theoretical scholarship into objects allows for the consideration of volcanoes in this manner. Work done by Object-Oriented Ontology (OOO), a form of critical inquiry that considers the existence of all objects, is key to the argument here. OOO scholars have charted new ground that historical and cultural work can use to focus on non-human objects.

Ian Bogost's *Alien Phenomenology* (2012) provides one of the most succinct descriptions of what OOO scholars do. Early on in *Alien Phenomenology*, Bogost asks "Why do we give the dead Civil War soldier, the guilty Manhattan project physicist, the oval-headed alien anthropomorph, and the intelligent celestial race so much more credence than the scoria cone, the obsidian fragment, the gypsum crystal, the capsicum pepper, and the propane flame?" (Bogost 3). At the core of Bogost's question is: why do scholars focus on human beings as the only important object of inquiry, rather than all objects? This rhetorical question points to an idea that decentralizes humanity, where humanity is not the only being or object on the planet worth examining in philosophical work. The question that Bogost is posing is central to Object-Oriented Ontology. Instead of assuming that human beings are the only things of philosophical interest in the world, Object-Oriented Ontology claims that all objects should be of philosophical interest, or as Bogost says OOO "puts things at the center of being. We humans are elements, but not the sole elements, of philosophical interest" (Bogost 6). While considering human beings and their existence is still important, according to OOO scholars, they are not the only object of interest. Bogost continues on to say that,

> In contemporary thought, things are usually taken either as the aggregation of ever smaller bits (scientific naturalism) or as constructions of human

> behavior and society (social relativism). OOO steers a path between the two, drawing attention to things at all scales (from atoms to alpacas, bits to blinis) and pondering their nature and relations with one another as much with ourselves. (Bogost 6)

Object-Oriented Ontology tries to cut a path between two kinds of reduction: one kind that argues that the world is almost absolutely divorced from human systems and another that argues the world is solely a production of those systems. Trying to move between these two extremes is important for understanding an object's individual being and also, even though Bogost does not state it, for trying to understand the complexity of the environment which is impacted by both non-human and human processes. Understanding the ways that objects including organisms exist in an environment is key to understanding the world ecologically or as a system, including the ways that humanity itself exists within the environment. As Timothy Morton, another OOO scholar, points out the value of Object-Oriented Ontology for understanding the environment is that OOO can be the grounding for "future ecological criticism: realist but not materialist, ecological but not Natural." ("Here Comes Everything" 168). The world exists, but is not reducible, the world is systemic, but not mystical. Everything has being and is an object within the environment, and it is the interaction of these objects that creates the environment.

On Bogost's (not comprehensive) list of objects that might be of interest are scoria cones (Bogost 3), also known as cinder cones, smaller volcanic phenomena that frequently accompany other larger volcanoes. Given how volcanoes can and have affected human history, considering the volcano and its being is a potentially valuable way of understanding not only how volcanoes change human life but also how human societies deal with environmental objects that are more powerful than themselves.

Object-Oriented Ontology allows for the consideration of volcanoes by themselves, not as extension of the human world or an object that is completely removed from human interaction. Volcanoes and human beings then are on the same field, but they are not equal in any sense. As Bogost points out "all things equally exist, yet they do not exist equally" (Bogost 11), which is especially true of volcanoes. They exist on orders and magnitudes of size and time and power larger than almost every other object on the planet. Even though volcanoes are often classified as sleeping giants, either dormant or active, they operate in a fashion that often exceeds human comprehension. Due to their particular way of being in the world, volcanoes exist at levels that far exceed other objects, placing them into a different class.

Timothy Morton coined the term hyperobjects to refer to objects that dwarf human beings in size, time, and scope. For Morton hyperobjects are objects whose being is in many ways more alien to humanity's own due to their immensity (*Hyperobjects* 2). Morton defines hyperobjects in this manner:

> Hyperobjects have numerous properties in common. They are *viscous*, which means that they 'stick' to beings that are involved with them. They are *nonlocal*; in other words, any 'local manifestation' of a hyperobject is not directly the hyperobject. They involved profoundly different temporalities than the human-scale ones we are used to. In particular, some very large hyperobjects, such as planets, have genuinely *Gaussian* temporality: they generate spacetime vortices, due to general relativity. Hyperobjects occupy a high-dimensional phase space that results in their being invisible to humans for stretches of time. And the exhibit their effects *interobjectively*; that is, they can be detected in a space that consists of interrelationships between aesthetic properties of objects. (*Hyperobjects* 1)

Therefore, hyperobjects possess the following qualities: they are non-local (in time and space), viscous, and interobjective. Morton lists oil fields, biospheres, nuclear materials,

and plastic bags as some potential hyperobjects, because they match the aforementioned categories (*Hyperobjects* 1). On their surface volcanoes may not seem to match these categories: they certainly seem to be local regardless of time or space, they do not appear especially sticky, nor do they manifest through a variety of other objects. Morton uses a volcano as a metaphor for hyperobjects (*Hyperobjects* 160) but does not connect the volcano itself with the idea. But volcanoes do have the features that make them hyperobjects, and that any attempt to understand volcanoes requires a recognition of volcanoes' status as hyperobjects.

The first, and most important category for the argument, is that volcanoes operate on "Gaussian temporalities" or different time scales: over tens or hundreds or thousands of years pressure builds in volcanoes, until they erupt. For example, Mount Tambora's devastating eruption in 1815, which caused the "Year without a Summer" in 1816, was Tambora's first eruption in about 1,072 years, give or take about 150 years ("Tambora"). The last time the Yellowstone Caldera erupted was in approximately 1350 BCE plus or minus two-hundred years, and that was seventeen-hundred years after the previous eruption in 3050 BCE ("Yellowstone"). These spaces of time easily defy direct human observation; people were alive during Tambora's and Yellowstone's last eruptions, but they were not engaged in the same networked scientific research and data collection as now. And no one person could possibly view the entire cycle from the buildup of magma to the eruption and then the relapse into relative quiet, until the next eruption.

These eruptions have a tendency to warp time because they create distinct points of dramatic change. For example, the years 1815 and 1817 are not important enough to

merit monikers. But Tambora's eruption earned 1816 its own name: the "Year Without a Summer" because of the widespread devastation the eruption caused (Wood 6). Tambora's devastation forced those living in 1816 to consider that year in particular. When Yellowstone erupts again, it will be a very well-remembered event; that year will earn a name or special recognition because of its volcanic activity. Volcanic eruptions also show how igneous action moves through human perception: volcanoes are only worth consideration during eruptions. The eruptions often operate in human time, a matter of hours or even days. The process of getting to those relatively brief eruptions takes far longer than a human life. Volcanoes operate on time scale that is far removed from the human experience of time, but volcanoes also interrupt human experiences, warping human life around their eruptions.

Not all volcanoes erupt like Tambora and Yellowstone which are two extremely slow volcanoes. By contrast, the Hawaiian volcano of Kīlauea, is very fast: erupting constantly with apparently little global impact. Fast volcanoes like Kīlauea would suggest that perhaps not all volcanoes occupy Gaussian temporalities because the eruptions are easily observed through time. Kīlauea has been erupting constantly since 1983, and before that off and on for thousands of years ("Kilauea"). One could watch a complete eruption of Kīlauea and then potentially see it start again. But witnessing an eruption is not necessarily enough to completely comprehend the volcano's scale through time. The Hawaiian Islands, and all 3,600 miles (5,800 kilometers) of the Hawaiian–Emperor seamount chain, have been built by the same eruptions over millions of years. Mauna Kea, the tallest volcano on Hawai‘i, is 13,796 feet (4,205 meters) in elevation. By some

estimates it is the tallest mountain in the world as it grows out of the 18,000 feet (5,500 meters) deep Hawaiian trough, totaling 31,796 feet (9,705 meters). And such great heights were not born of a quick massive eruption, but the same frequent low viscosity eruptions that come from Kīlauea. These eruptions, like the inverse of the erosion of the Grand Canyon, have slowly built up islands. Even now the Hawaiian Hotspot is building the Lōʻihi Seamount twenty-two miles (thirty-five kilometers) off the coast of Hawaiʻi. Lōʻihi is already about ten-thousand feet (three-thousand meters) high and will in "roughly 10,000 to 100,000 years" reach the surface of the Pacific ocean ("Loihi"). Even though the Hawaiian volcanoes are in almost constant action, they still defy human temporal scales, taking centuries to grow. Regardless of whether one looks at a slow volcano or a fast volcano, their operations still expand beyond the human perception of time, instead occupying Gaussian temporalities. Of all the ways that volcanoes exist, their expanse through time makes them the most difficult to grasp. Volcanoes' immensity in time also surprisingly makes them vast in space, non-local, in often unconsidered ways.

Volcanoes have the hardest time overcoming the idea of being nonlocal in space, as other hyperobjects are. Volcanoes are obviously local, they occupy a space on maps; Vesuvius will only ever threaten Naples, never London. If anything, volcanoes appear hyper-local, not non-local because they do not move, unlike a phenomenon like global climate change which will not affect only one locale. But volcanoes, even though they do not seem like it, are not static. The Hawaiian–Emperor seamount chain shows that volcanoes are not static. As the Pacific plate has moved over the hotspot, and likewise as the hotspot has moved, a long line of islands have emerged that are roughly the same

length as a flight from Washington D. C. to London. A volcano that can travel such distance is not local. Part of the problem is the question of *when* the hyperobject is local: certainly the Hawaiian hotpot has been moving and is currently moving, but due to the first feature of the volcano, the time scale upon which that action occurs, it vastly dwarfs a person's ability to see the movement occurring. Thus a volcano's locality depends on the scale of time that is being used to measure it. For all human observers, Hawai‘i appears to have occupied the same space continuously, despite the fact that it has been in constant motion. Locality is a function of time, and given that volcanoes do not operate in human time, trying to fix the location of a volcano is impossible in geologic time. But, beyond the sense that volcanoes are in constant motion, thanks to the movement of the plates that they rest upon, they are not constrained in space in the ways that they interact with other objects.

Another strike against the idea that volcanoes are non-local is the distribution of their effects. Vesuvius has not threatened London recently, but the eruption of Eyjafjallajökull, in 2010, affected London and the rest of Europe by disrupting travel, and therefore also affected everyone who wanted to get to Europe. Even though Eyjafjallajökull has a specific location on the globe, it has the power to affect more than just Iceland. As noted by Harris et al. the impact of Eyjafjallajökull's eruption were quite large affecting "7 million people (who became stranded during the air space closure), plus the ∼100,000 flight cancellations and $1.6 billion losses suffered by airlines" (Harris et al. 34). Eyjafjallajökull is not radically altering the entire globe in one fell swoop, but it is rearranging the lives and fortunes of more people than just the ones that live nearby.

Returning to the "Year without a Summer," Tambora's 1815 eruption is often counted as the deadliest volcanic eruption in modern human history. Tambora's death toll was not a function of lava or pyroclastic flows, but of its ash cloud which caused widespread famine, killing as many as 49,000 people (Oppenheimer 50). To survive people ate whatever they could find: boiled nettles in Vermont and clay in China (G. Wood 9). So even though Tambora is located in Indonesia, it has enough force to affect people across Asia, Europe, and North America. Tambora is not unique in that ability. When Yellowstone eventually erupts it will no doubt affect more than just North America. Climate-altering ash clouds are just one potential way a volcano could affect the environment; volcanoes can also release poisonous gas clouds, tsunamis, and a variety of other environment altering effects. Despite the apparently static placement of volcanoes, they can have effects that span the globe. In these ways, through constant movement and worldwide impact, volcanoes are non-local in space. Thus volcanoes meet the first categories of hyperobjects because their mode of existence is alien to human observers: they occupy different temporal and spatial scales. But by existing in such a manner, they are difficult for human beings to detect merely using observation. Only through a variety of objects and tools do volcanoes start to become visible.

Morton notes that hyperobjects are largely invisible to human beings and that they are formed through the interactions of a variety of objects. Volcanoes themselves are formed by either plate tectonics or mantle plumes. The most common type of volcano is formed by the subduction of one tectonic plate under another. As one plate moves under the other, the descending plate begins to melt. The melt is caused by the extreme

pressures and temperatures the rock encounters at depth in conjunction with the water that has infiltrated the subducting plate. The melting turns rock to magma. The magma, because it is often less dense, rises through the mantle and collects under the crust. There it melts surrounding rock further, decreasing its density, and it heats the crust until the crust fractures allowing the magma to rise higher. This fracturing eventually expresses itself as some kinds of mountains ranges and volcanoes, which erupt the magma unto the surface. The process of going from subduction to volcano is quite complicated and involves a variety of objects and mechanics working in conjunction: volatile gases, extreme pressures and temperatures, particular interactions between the crust and the mantle. Most of that work is out of sight, miles deep under the crust. Volcanoes are a side-effect of plate tectonics, a hyperobject nested inside of another hyperobject. For the argument here, volcanoes are their own hyperobject, one which human beings use a variety of objects to describe and understand. Morton's claim is that hyperobjects are constituted of other objects; the claim could be expanded to say that hyperobjects also require a diversity of objects, tools, to be understood or even perceived.

In the early twenty-first century, science is seen as the preeminent mode for explaining the world. Science uses a variety of methods and technologies to help it perceive the imperceptible and interpret data. The scientific mode has been used by those who study volcanoes for about the last two-hundred years. Volcanologists use an arsenal of tools to chart volcanoes: seismometers, seismographs, electronic distance measurement guns, global positioning tools, correlation spectrometers, very low-frequency signals, EM-31 ground conductivity meters, video cameras, still cameras,

infrared cameras, satellite imagers, etc. This list does not include the various layers of protective gear that volcanologists wear so that they can merely approach a lava flow or volcano. These are merely the tools for field research. Laboratory research likewise has its own distinct tools. Both of these have computer programs which collect and display the data. The work of volcanologists is exceedingly valuable, as they help human societies better understand and prepare for inevitable eruptions. But to make those predictions, volcanologists require all of these technologies to perceive or understand the volcanoes and their mechanisms. Other objects do not require such an array of perception-extending tools, because they are visible without those tools. The usage of multiple objects to help understand volcanoes points to the volcano's status as a hyperobject. However, scientific tools are not the only way of perceiving a volcano. Culture has also defined the ways that human beings see volcanoes by determining what is or is not a volcano.

Narratives, and other aspects of culture, provide ways to understand or perceive volcanoes. Volcanoes are well suited for narratives due to the causal nature that most narratives adopt; the plots move through time and the characters are affected by their actions and the world. Volcanoes move through time, building pressure and then eventually erupting. Volcanoes in narrative present an understanding of the geologic phenomena. For example, in 2014 the film *Pompeii* was released. As the title advertises, the film is about the 79 CE eruption of Vesuvius. Importantly, the film is part of the disaster movie genre, which revolves around an impending doom. Unsurprisingly, Vesuvius in the film is the ultimate killer, ending the lives of both the antagonistic

Roman politicians and the heroic slave-gladiators. Only two years before, the film *2012* used the Yellowstone Caldera's eventual eruption as one element of a massive flood that kills most of human life. Even though it is flooding that destroys humanity, volcanoes still manage to enter the stage to participate in the destruction.

Volcanoes are elements of non-disaster films too. For example, *The Lord of the Rings*, in both the novels from 1954-1955 and the films from 2001-2003, the volcano, Mount Doom, plays an important role as both the place where the One Ring is forged and also the only place where it can be unforged. In the fantasy series *Game of Thrones* (1996-Present), a volcanic catastrophe is the important catalyst for the destruction of an ancient Rome-like civilization. The collapse of the Rome-like civilization subsequently causes the rise of a new monarchy descended from refugees of that volcanic catastrophe whose rule and misrule are the source of much of the geo-political action of the novels. In the sixth *Star Wars* film, *Revenge of the Sith* (2005), the final battle between the protagonist Obi-Wan Kenobi and the fallen-hero Anakin Skywalker takes place on a planet that is a patchwork of active lava fields, slightly cooled lava rocks, and industrial production facilities. After this battle, Anakin Skywalker becomes Darth Vader, the antagonist for the following three *Star Wars* films. In *Star Trek: Into Darkness* (2013), the crew of the *USS Enterprise* decide to violate the principal of non-intervention by saving an alien race from volcanic extinction, descending into the volcano and setting off a cold fusion bomb. Even in narratives that do not center on volcanoes, they still manage to find ways into the plot, and often their deadliness is at center stage.

Volcanic representations can also be found in day-to-day life. On the smallest level there is the baking soda volcano, which has very little to do with actual volcanoes. The object is merely a papier-mâché cone, perhaps painted, filled with sodium bicarbonate then mixed with acetic acid. The volcano is supposed to be teaching tool for children. The experiment gives children a partial representation of what volcanoes do, or how they act. Or there is the lava cake, or molten chocolate cake, which is a chocolate cake that has a center of melted chocolate and is often topped with powdered sugar and fruit. As one uses the fork to carve into the "snow-topped" peak, molten "lava" will flow out of the cake. The cake matches an idea of the volcano: a cone from which molten liquid pours out of. Or there is the still somewhat popular lava lamp, which contrary to the title, is filled with wax that is constantly melted and cooled. The lamp is designed to imitate the smooth flow of pāhoehoe lava, although in a fashion that rarely threatens houses. From the volcanologist to the movie-goer, the college student to the child in the kitchen, a variety of tools help humanity understand and/or misunderstand volcanoes, so that volcanoes are a part of a network of scientific and cultural knowledge. These tools are important, because the volcano itself is really a network of other objects and forces that are difficult to see completely. Despite the difficulty of seeing volcanoes completely, they do manage to adhere to culture in unexpected ways.

The last quality that Morton ascribes to hyperobjects is that they are "viscous" which means that they adhere to the other objects that they interact with. On a physical level, volcanoes, especially their lava, are quite sticky. The advancing rivers of molten rock from a volcano easily surround, melt, and burn whatever they find in their paths. But

viscosity as a quality refers to more than just whether or not a volcano might stick to a particular place, or how lava sticks to the landscape. Viscosity means that volcanoes are to a degree inescapable, that as an object they maintain connections to a variety of other objects. Volcanoes are often reduced to one eruption. That eruption is the end of what a volcano is or does, merely the reaction at the end of years of pressure. But volcanoes are more than single eruptions, they spiral out, with layers of effects like long- and short-term hazards, and even benefits. For example, volcanic soil, soil that is composed of eroded volcanic rock, is surprisingly fertile. While volcanic soils only cover about .07% of the earth's surface, they support about 10% of the earth's population through agriculture (Delmelle et al. 1253). Similarly many kinds of volcanic rocks are used for industrial or commercial purposes, like pumice which is often sold as an abrasive, in addition to an absorbent or an insulator (Dehn and Mcnutt 1277). Volcanoes are more tightly enmeshed with human society, especially in a globalized age, than might otherwise be apparent. And volcanoes themselves tug at human networks, drawing people to places like Naples, Hawai‘i, Yellowstone, or Iceland merely for the chance to see the dynamism of the earth in action. Even though humanity often considers volcanoes only in those moments that they erupt, volcanoes manage to stick around, adhering to human life.

Therefore, volcanoes are hyperobjects, in that their mode of being expands through space and time, they are difficult to see without other objects, and they stick to everything. Recognizing volcanoes means that they can be better understood as categorically different than other objects in the world. As Bogost points out, while the being of all objects should be of interest, objects themselves do not have equal being in

the world; volcanoes, like any massive object, have a gravitational pull, affecting the other objects around them because of their hyperobject nature. Despite that, Bogost says of hyperobjects that humanity draws "them closer and farther from us based on how well they match our own understanding of the world" (Bogost 79). The more a hyperobject fits any given a cultural framework, the more likely culture is to see the hyperobject as part of the human frame. Morton notes though that hyperobjects are pushing upon human societies now more than ever: "the encroachment of hyperobjects, one of which is assuredly Earth itself, and its geological cycles demand a *geophilosophy* that doesn't think simply in terms of human events and human significance" (*Hyperobjects* 7). Thinking about the world, not in human terms, but in terrestrial terms means the potential for understanding it better. The same is possible with volcanoes. Climate change is explicitly a hyperobject (*Hyperobject* 3), and therefore the argument here will sketch an understanding of volcanoes to provide a framework for the historical understanding of hyperobjects. The goal is to draw parallels between volcanoes in the nineteenth century and climate change in the twenty-first. Understanding hyperobjects' being in the world is important because hyperobjects tend to dictate how other objects and beings, like human beings, exist in the world.

One of the criticisms of OOO is that it is anti-human or fetishizes objects. But Bogost points out that OOO does not try to divorce itself completely from the human. OOO tries to bring other modes of being to the table equally. Bogost describes a collaboration with Nick Montfort on platform studies, where people are not extracted from the analysis but merely a part of the collected objects of study: "In our treatment of

computer hardware, Montfort and I devote considerable attention to matters of business, culture, society, reception, and so forth. But we also pay attention to all the other real things that cultural studies tends to ignore, in this case the construction and operation of particular computer systems, and why they work the way they do" (Bogost 132). The argument here embraces that mode of Object-Oriented Ontology, by showing human connections with volcanoes, and also by describing and understanding volcanic mechanics and process. In fact, volcanoes are difficult to understand without a discussion of their being because unlike other objects, volcanoes are incredibly dynamic and manifest in a variety of ways. As shown above, volcanoes are hyperobjects, but they only were recognized as hyperobjects through the work of literary and scientific texts in the eighteenth and nineteenth centuries.

The aesthetic work of literature and the empirical work of science made features of volcanoes, like their immensity through time, visible to readers. While scientific work was important, helping to define volcanic mechanisms, literary work was key to imbedding volcanoes and their existence within culture. The goal of the dissertation is show how writers in the eighteenth and nineteenth centuries developed an understanding volcanoes as hyperobjects: the work required to perceiving deep time and non-locality. By seeing how writers in those centuries expanded recognition of environmental hyperobjects, the dissertation will suggest methods by which hyperobjects today, especially climate change, might also gain expanded recognition, allowing for improved social and political responses.

Chapter 1, “Three Views of Vesuvius” - The first chapter uses the scientific account of Sir William Hamilton, *Observations on Mount Vesuvius, Mount Etna, and other volcanos* (1774); in conjunction with Hester Piozzi’s travelogue *Observations and Reflections Made in the Course of a Journey Through France, Italy and Germany* (1789); and Priscilla Wakefield’s educational novel for children *The Juvenile Travellers* (1801) to show the various ways that volcanoes, especially Vesuvius, were conceptualized before the nineteenth century. Vesuvius is perhaps the most famous volcano in human history, and its existence has fascinated Europeans for some time. Hamilton's investigations of Vesuvius gave unprecedented insight unto the mechanics of volcanoes. Hamilton develops a theory of volcanoes through his letters, slowly crafting the idea that volcanoes are part of a massive system, rather than a more marginal fire on top of a mountain. He develops a sense of the time scale that volcanoes operate through, providing a foundation for other geologists like James Hutton. Hamilton theorizes a Vesuvius that exists beyond human society and outside of the current realms of knowledge. Piozzi’s travelogue engages with Vesuvius, but in an aesthetic rather than scientific fashion. Piozzi shows a comprehension of the massive time that volcanoes operate on. She crafts moments in her travelogue that ask the reader to think about geologic time and the insignificance of human life in the face of that time. Accordingly, she records the sublime nature of the volcano and how it affects her. Wakefield’s educational novel likewise acknowledges the sublime nature of volcanoes, and their relationships with humanity, incorporating volcanoes into a larger human-volcano system. These popular texts show the diversity and similarities of volcanic perceptions.

The descriptions of volcanoes by the writers grant volcanoes existence that sometimes overwhelms humanity, certainly through time and sometimes through force. Hamilton's scientific treatise, Piozzi's travelogue, and Wakefield's educational novel show the edge of volcanoes starting to be granted their own being, dwarfing human civilization.

Chapter 2, "The Last Days of the Symbolic Volcano" - The second chapter focuses on Edward Bulwer-Lytton's novel *The Last Days of Pompeii* (1834) and Charles Lyell's text *The Principles of Geology* (1830-33) to show how volcanoes were stripped of metaphysical meaning as the nineteenth century progressed. *The Last Days of Pompeii* follows a series of characters alive in 79 CE right up to the eruption of Vesuvius. The novel includes a collection of Christian characters, part of Christian mystery cult, who end up converting some of the main Roman characters. They are opposed by the pagan religions of Roman and Egypt. Yet, when the eruption of Vesuvius occurs, the volcano kills indiscriminately; the volcano does not kill the non-believers and save the believers. Bulwer-Lytton uses religion, history, and science to construct a Vesuvius that defies symbolism. Rather Vesuvius in the novel is more like its real counterpart: just a volcano, unconcerned with human events. Lyell's text uses both empirical data, logic, and aesthetic descriptions to show that volcanoes are the products of long acting, uniform forces rather than the product of a Noachian flood or chemical fires. Both texts start to view the volcano as having an existence that is its own, rather than some extension of human existence. Seeing volcanoes as volcanoes means first seeing how they are not extensions of human social systems. While human interpretations will always be limited and imperfect, philosophically respecting other beings and objects means attempting to

reduce anthropocentric views on those beings and objects as much as possible. Thus to see Vesuvius as a volcano, it cannot be the home of any gods or an instrument of wrath. While Lyell and Bulwer-Lytton would not end the use of volcanoes as symbols in human life, they help start the process of removing human meaning from volcanoes, providing volcanoes the philosophical distance necessary to be viewed as objects in their own right.

Chapter 3, “Constance Gordon Cumming and the Disappointing Volcano” - The third chapter contrasts the eruption of Krakatoa in 1883 with Constance Gordon-Cumming’s travel journal *The Fire Fountains* (1883) and her interactions with Kīlauea on Hawai‘i to show how even towards the end of the century trying to connect human minds with the process of volcanic phenomena was a substantial challenge. Krakatoa’s eruption was seemly apocalyptic: thousands of people dead, an entire island obliterated, reports of days without sunlight, and so on. The volcanoes of Hawai‘i do not typically erupt in such a fashion. The Hawaiian volcanoes erupt frequently because the composition of their magma is much more fluid, unlike Krakatoa’s. Constance Gordon-Cumming goes to Hawai‘i in 1879 to see Kīlauea because of its spectacular nature. Once she finally ascends to Kīlauea's mouth, Gordon-Cumming is incredibly disappointed. The crater of Kīlauea is just a blue-black pit of cooled lava with some smoke coming off of it. Fortunately for Gordon-Cumming she stays long enough to see a new lava lake form, and then she is entranced. Gordon-Cumming's experience of Kīlauea in contrast with the spectacle of Krakatoa shows just how difficult it is for human minds to perceive geologic time: volcanoes only enter into view when they are erupting, even though they have an impact that stretch far beyond that. Encounters and descriptions of new kinds of

volcanoes, like Kīlauea, helped expand the understanding of volcanic action by showing the diversity of volcanoes and the ways they move through time and space.

Chapter 4, "M. P. Shiel's Volcanic Hope" - The last chapter considers M. P. Shiel's *The Purple Cloud* (1901) and its incorporation of new theories of volcanism and continental drift. The novel shows how human beings are impacted by volcanoes beyond mere destruction, how volcanoes alter and determine the human environment. *The Purple Cloud* follows Adam Jefferson on an expedition to the North Pole. When Adam reaches the pole, a supervolcanic eruption spreads hydrogen cyanide gas throughout the world killing humanity. Adam eventually discovers another person, a woman, Leda. Together they restart the human race which Adam suggests will be a better one. Shiel uses a wide range of a scientific knowledge, such as chemistry, geology, and thermodynamics support the narrative. *The Purple Cloud* focuses on the question of entropy, asking whether both the human race and the earth itself are near extinction. The answer that the novel provides that that neither is on the edge of running out of energy. Instead, Shiel's novel establishes fundamental linkages between human societies and the geological processes of the earth. The novel uses volcanoes as a mass extinction event to determine what the future of the human race will be. So while Shiel's text appears to be quite grim, it ends up being optimistic as volcanic action helps set humanity on a new more diverse, less decadent track. The novel argues for an understanding of the human race's reliance upon its environment, especially volcanoes as they radically alter human fates. *The Purple Cloud* realizes volcanoes' status as hyperobjects, seeing their scale in time and their effects upon

human culture, without reference to meaning. As the novel shows, by the end of the nineteenth century volcanoes were understood as hyperobjects,

Volcanoes are unique phenomena on the earth as they can alter the environment radically, like humanity, but operate over scales of time and through mechanisms that are vastly larger than human beings. Anthropogenic climate change is a relatively recent occurrence. Volcanoes, because they can cause changes in the climate, are another set of data available for consideration. As Wood puts it, understanding volcanoes and their effects allows human societies to understand the future of the world "reflecting on Tambora's three-year extreme weather regime of the early nineteenth century, we cannot predict what the mortality rates of our own extended climate emergency will be in the Anthropocene age" (G. Wood 233). This dissertation adds to Wood's claim through understanding how people in the eighteenth and nineteenth centuries conceived of volcanoes' and their modes of existence. By understanding how people developed an understanding of massive environmental objects in the past, people today can work towards a better understanding of current hyperobjects like climate change.

Ecological research has burgeoned in recent years, one way that the humanities can help further that research is through historical and ontological studies. By looking at a variety of objects and their modes of existence, especially through history and literature, scholars have the potential to understand the constituent elements of the environment, meaning that they can make better determinations about how human culture should exist in the environment. Humanities' thinking already embraces large scales and complex networks, by better understanding objects scholars can see how objects form an

environment. The eighteenth and nineteenth centuries are crucial to understanding environment and culture in the twenty-first century. Waters et al. suggest that the Anthropocene starts in the 1950s (Waters et al. 145) but others have argued that the Anthropocene could be said to start in either 1700s or 1800s (Waters et al. 138). Regardless of which of these start points is chosen, the eighteenth and the nineteenth century are absolutely key as they either setup or start the Anthropocene. Morton notes that human societies have entered a "time of hyperobjects" where even mundane questions about the weather are fraught with anxiety about climate change (*Hyperobjects* 99). The Anthropocene and hyperobjects are linked for human civilization. Examining one of the first hyperobjects, the volcano, in the historical inception of the Anthropocene, 1766-1901, is valuable as that study can show how thinking about hyperobjects developed helping better understand hyperobjects today. The literature and science of the eighteenth and nineteenth centuries are crucial pieces of data for understanding culture's connections to and reflections on the environment. Volcanoes are but one piece in an environmental network, but understanding them shows the lines of force that tether human civilization to geologic process.

THREE VIEWS OF VESUVIUS

Volcanoes were a popular topic in the eighteenth century thanks to the improving explanatory power of natural philosophy and the rediscovery of Pompeii. Vesuvius was the focus of much of this volcanic interest. As the only active volcano on mainland Europe, Vesuvius was accessible and yet benign enough to visit. Many Britons visited Vesuvius and wrote about their experiences. This chapter will focus on three of the most popular texts of the last half of the eighteenth century and how they understood the volcano, especially how they independently developed ideas of deep time and systematic connections between volcanoes and human civilization. First will be Sir William Hamilton's *Observations on Mount Vesuvius, Mount Etna, and other volcanos* (1772), a scientific report to the Royal Society. Hamilton's observations not only helped increase Vesuvian enthusiasm, they were also revolutionary for both geology and volcanology. In the text Hamilton develops a theory of volcanic action that systematizes and contextualizes volcanoes in time, laying an important foundation for subsequent scholars of the earth and volcanoes. Next the chapter will turn to Hester Piozzi's *Observations and Reflections Made in the Course of a Journey Through France, Italy and Germany* (1789), a genre-bending travelogue that focuses on experience not an exact accounting of time. Piozzi used her observations to communicate more directly the sensation and experience of the Grand Tour to her reader. During her travels she visits Vesuvius and describes her impressions and emotions. She also develops an understanding of volcanic action that stretches through time, seemingly outside of human impressions. While Piozzi does not see volcanoes as part of system, she does see the ways that they tower over human lives

and affairs. Last the chapter will consider Priscilla Wakefield's *The Juvenile Travellers* (1801), a fictional travel diary designed to instruct children on the places, people, and climates of Europe. Wakefield's text sees her main characters visiting and hiking upon both Vesuvius and Pompeii. While Wakefield's text does not take up the idea of a geological system, she does emphasize to her young readers the very real impact that volcanoes have, connecting with Piozzi's sense that volcanoes are greater than human beings, and that volcanoes are understandable through empiricism and science. Vesuvius is an important part of all three of these texts, and Hamilton, Piozzi, and Wakefield help define the ways that eighteenth- and nineteenth-century audiences saw volcanoes. While there was not singular conception of volcanoes at this time, there were important trends demonstrated in these texts like the powerlessness of humanity in the face of volcanoes and the value of experienced-based inquiry as a way of understanding natural phenomena. Collectively, these text show the development of the idea of geologic deep time within culture and the causal relationship between volcanoes and human civilization.

The study of volcanoes was not a discreet scientific field in the eighteenth century, but rather a feature of natural philosophy. Natural philosophy was a combination of disciplines now defined as geology, chemistry, physics, theology, philosophy, and history. At that time there were two important schools of geological thought with natural philosophy, Neptunism and Plutonism, each of which had different theories for the creation of the earth. Neptunist theory stated that the earth had been completely formed during global or local flooding. Therefore it was named after the Roman god of the sea, Neptune. The theory speculated that water had covered the world, then receded. As the

water receded, rock was deposited forming mountains, valleys, etc. Plutonist theory, on the other hand, argued that there was a central heat or fire within the earth. Therefore it was named after the Roman god of the underworld, Pluto. According to Plutonists volcanic activity, caused by a central heat, formed rocks, which were eroded and reformed. These theories both saw volcanoes differently. Scholars like Robert Hooke, Robert Boyle, and Isaac Newton thought that volcanoes were the result of chemical reactions, like the burning of sulfur and potassium nitrate (Sigurdsson 103-104). René Descartes believed that the earth was a cooling star and that the residual heat from the core was the power source for volcanoes (Sigurdsson 105). Georges-Louis Leclerc, Comte de Buffon, although a Plutonist, thought that volcanoes were chemical (Sigurdsson 107). All of these theories would be further complicated by Abraham Gottlieb Werner, who articulated the Neptunist theory in the latter half of the eighteenth century after looking at basalt, a volcanic rock, and determining that it was aqueous in origin (Sigurdsson 117). The Neptunist argument dominated because it agreed with Biblical creation and it was more easily observable, in contrast to the Plutonist's inexplicable, unobservable central heat. In this melee of theories modern geology and volcanology would appear. One of the most important figures in the history of the study of volcanoes, especially for the data that he collected, was not a professional natural philosopher but instead a diplomat and an art collector, Sir William Hamilton.

1. Sir William Hamilton

Sir William Hamilton (1731-1803) was the British ambassador to the Kingdom of Naples. He was born to Lord Archibald Hamilton and Lady Jane Hamilton, and spent his formative years growing up with the future George III (Morson). William was educated at Westminster School, and then entered the army, serving from 1747 to 1758. After the Army, William became a member of parliament in 1761. In 1758 he married Catherine Barlow, the daughter of a Scottish landowner. Catherine "was educated, retiring, and of delicate health; she probably suffered from asthma" (Morson). William and Catherine's "match suited all parties" (Constantine 10) fortunately as William gained fiscally from the situation and Catherine gained social stability. And Catherine and William seemed to have enjoyed a happy marriage (Constantine 11). But Catherine was frequently ill. To fix that the Hamiltons needed a milder climate. William had learned that the current ambassador to Naples, James Gray, was planning on retiring, so he sent out letters to his superiors positioning himself as a candidate for the post (Constantine 14-15). There was nothing about Naples, certainly not Vesuvius, which drew William to apply; he merely wanted to find an environment that would be easier on Catherine. William became the ambassador to the Kingdom of Naples in 1764 and he and Catherine arrived in Naples later that year (Morson). Not only had William helped prolong his wife's life, but he would also establish himself in volcanological history through his enthusiasm.

In the eighteenth century, Naples was the second largest city on the continent of Europe, after Paris (Constantine 19) and was at that moment enjoying "a golden age of

art, architecture, science, literature, and music" (Morson). Naples, and Southern Italy in general, are also the most volcanically active part of Europe, not counting Iceland. Southern Italy is on the edge of the convergent plate boundary between the African Plate and the Eurasian plate. The African Plate is, mostly, being subducted under the Eurasian plate. This means that the African plate is being forced by differences in density under the Eurasian plate. As the rock from the surface gets forced down, it melts, and subsequently rises where it can erupt (Perfit and Davidson 90-91). The volcanoes of Italy, as with many volcanoes in the world, are caused by subduction. Hamilton had lucked into not merely a cultural capital but also an active volcanic field. Hamilton's job was not too demanding: he had to report to the Secretary of State, he had to gather information on Naples, and he had to represent and advocate for British interests in Naples (Constantine 23-25). These official tasks did not stop him from pursuing art, antiquities, and volcanoes.

In 1765 Hamilton climbed Vesuvius to investigate the volcano's increasing restlessness (Constantine 34). There he observed the volcano in action. Afterwards he wrote up his observations and sent them to the Royal Society in London. At Royal Society meetings Hamilton's letters were read aloud (K. Wood 76). Subsequently, his accounts were sent out to all the members of the "Royal Society, 418 at home and 140 aboard in 1776" through the *Philosophical Transactions of the Royal Society*; non-society members could also purchase copies themselves in London (K. Wood 85). Hamilton's letters were popular enough that the publisher Thomas Cadell "won the author's approval to compile a small, cheap edition of the letters" (K. Wood 86) making Hamilton's

observations even more accessible. Cadell's edition took five letters that Hamilton wrote to the Royal Society, between 1766 and 1771, and bound them together in *Observations on Mount Vesuvius, Mount Etna, and other volcanos* (1772). Hamilton Quickly became known as one of the foremost volcanological thinkers of the age.

In 1771 Hamilton was awarded the Copley Medal, the most prestigious award given by the Royal Society, for his work on volcanoes (Constantine 65). Hamilton's investigations were such that he was referred to as "le Pline moderne" [the modern Pliny] by some (Constantine 29) a reference to Pliny the Younger and his account of Vesuvius's destruction of Pompeii and Herculaneum. Even Voltaire, an acquaintance of both of the Hamiltons, received a copy of the *Observations* and wrote to Hamilton to thank him (Constantine 70). In 1773, Hamilton published *Campi Phlegraei*, and a supplement in 1779, which took all of his letters about volcanoes, including ones after 1771, in addition to new illustrations which he commissioned, and bound them together. While that text is more comprehensive, the *Campi Phlegraei* was also a "luxury object" (K. Wood 88) thus harder to obtain and read. Wood notes that "the small-scale production, high demand and exorbitant cost" meant that many readers could only encounter *Campi Phlegraei* through reviews in monthly magazines (K. Wood 92). Therefore, this chapter will focus the *Observations* as printed by Cadell, because it was the more widely circulated text. The work was even republished twice (*Vesuvius* 203), which means that even more people had access. Hamilton's letters ended up influencing the next generation geologists; both Charles Lyell and George Scrope cited Hamilton in developing their own theories (Sleep

333). William Hamilton, although initially merely an observer, was one of the central figures in late eighteen-century understandings of volcanoes.

Hamilton's first letter published in the book, from June 10th 1766, starts off humbly, addressing the president of the Royal Society and hoping that his observations on the volcano are not "unacceptable" (W. Hamilton 1). He quickly restricts his work, saying that he will only relate his observations, he will not interpret or analyze them, leaving that to "the more learned in Natural Philosophy" (W. Hamilton 2). For his first letter, Hamilton approaches the Royal Society very tactically: he is a diplomat and soldier, not a natural philosopher. To be accepted by natural philosophers, Hamilton makes sure that he presents himself humbly to the members of the Royal Society so that they will allow him space to speak. Hamilton does try to remain as objective as possible by reporting the facts not interpretations. In later letters Hamilton makes more space for himself to interpret the volcano, but the first letter is fairly subdued.

From September 1764 to February 1767, Vesuvius was erupting ("Vesuvius") which Hamilton recorded. For the first few months, the volcano only smoked, but later it would erupt lava. First Hamilton describes the kinds of smoke that came from the volcano, their colors and volumes, in addition to the other conditions of the area, like whether the weather was fair or foul. He mentions hiking to the top of the volcano and peering inside, but all he reports is that the mouth of the Vesuvius is encrusted with "salts and minerals of various colors, white, green, deep and pale yellow" (W. Hamilton 3). Hamilton approaches the volcano as a scientific object and his own role there as merely the Royal Society's cipher, gathering data that they could not gather themselves. Later,

when lava begins to flow from Vesuvius, Hamilton also carries out experiments. He pokes lava flows with sticks or throws rocks on them (W. Hamilton 10). And, like a good eighteenth-century mineralogist, Hamilton collects samples from the eruption and sends them back (W. Hamilton 16). Not all of Hamilton's first letter is so reserved though.

When, on the 28th of March, Vesuvius began to erupt lava Hamilton's reaction is not quite as sober as his other reports: "Immediately upon sight of the lava, I left Naples, with a party of my countrymen, whom I found as impatient as myself to satisfy their curiosity in examining so curious an operation of nature" (W. Hamilton 6). Hamilton and his party rush to volcano and end up spending the entire night roaming over Vesuvius, watching the lava streams. He still adheres to the need for data, describing the lava flows from Vesuvius's mouth, how they looked and moved. But Hamilton also notes that the lava is a "most beautiful and uncommon cascade" (W. Hamilton 6-7). Hamilton by categorizing the aesthetic qualities of the eruption is starting to interpret the data. This interpretive insertion would not be Hamilton's last. He sees the mountain as a source of unique beauty despite its danger. Hamilton is aware of the perilous nature of his observations, he mentions being cautious, although for many being cautious would mean not approaching the mouth of an active volcano. Hamilton and his party spend the night on Vesuvius watching the lava flow (W. Hamilton 7) which again defies the caution of many. Vesuvius fascinated Hamilton, causing him to visit many times, despite the danger. Hamilton also makes connection between human life and volcanic eruptions.

Early in Vesuvius's eruption, Hamilton notes that the volcanic ash from the mountain "did great damage to the vineyards" (W. Hamilton 4). Later on, he describes

the advancing lava as it consumes another vineyard, saying that he saw the lava "unmercifully destroy a poor man's vineyard, and surround his cottage, notwithstanding the opposition of many images of St. Januarius" (W. Hamilton 11). The image of St. Januarius, the patron saint of Naples, was supposed to protect the farmer's land. Hamilton, an Anglican (Morson), is dismissive of the Catholic farmer's attempts to use the Neapolitan Saint to ward off the lava. But he does seem sympathetic to the farmer, describing him as poor and the lava as unmerciful. In a footnote, added for the printing of the letters, Hamilton mentions lava diversions, channels around the city for the lava to flow through, to save human structures (W. Hamilton 12). Even though Hamilton does not often focus on human beings, he still does make time to note that humans and volcanoes are connected. In an earlier footnote, Hamilton makes the even more radical claim that while volcanoes and their ash are "greatly detrimental to vegetation for a year or two; but are certainly of great service to the land in general" (W. Hamilton 5). He is suggesting that volcanic ash is beneficial to the land. Charles Lyell would echo the idea sixty-five years later (Lyell 359) and the long-term agricultural benefits of volcanic ash have subsequently been proven (Delmelle et al. 1253). Hamilton is already making connections between human beings and volcanoes, despite only observing Vesuvius. The first letter ends with Hamilton stating that his description "is not exaggerated" (W. Hamilton 15). In this first missive he has started to define volcanoes, if only superficially as both beautiful and dangerous, and both a bane and boon to humanity.

Hamilton's second letter, from December 29th, 1767, records the last explosions of the 1764 to 1767 Vesuvian eruption. Again, Hamilton gives a detailed account of the

scene, especially the climatic ending of the eruption, including data gathered directly from lava flows (W. Hamilton 36). He also goes so far as to include a painting in addition to the samples that he sends along with his narrative (W. Hamilton 40). After only one letter, Hamilton expands the kinds of evidence that he includes to better help his audience understand what he is observing, but also to convince them of his claims. Unlike his first letter, where there is only observation, the second starts advancing interpretations about volcanoes. One of the drawings shows the growth of the lava dome before the eruption. The seven drawings, from between July 1767 and October 1767, show the dome increase in size until it blows its top off. Hamilton comments about the dome that "I had watched the growing of this little mountain; and by taking drawings of it from time to time, I could perceive its increase most minutely. I make no doubt that the whole of Mount Vesuvius has been formed in the same manner" (W. Hamilton 22-23). For an eighteenth-century natural philosopher, Hamilton's claim is striking because he is starting to align himself with the Plutonists, if only tacitly, by positing that volcanoes grow up, instead of being deposited down.

Beyond the growth of the volcano, Hamilton also begins to speculate about the cause behind volcanic explosions. He notes that before the explosions he "had observed a great fermentation in the mountain after the heavy rains" (W. Hamilton 23-24). Using "fermentation" to describe the scenario shows that Hamilton in part believes the chemical theory of volcanic action, or at least a quasi-chemical theory. Typically, fermentation refers to the adding of heat to a substance which causes it to change, including sugars with yeast or bacteria to create gases or alcohols. But in the eighteenth century the *Oxford*

English Dictionary notes that "before the rise of modern chemistry, the term was applied to all chemical changes exhibiting these characters; in Alchemy, it was the name of an internal change supposed to be produced in metals by a 'ferment', operating after the manner of leaven" ("fermentation, n."). So the idea of heating water and chemicals in the crucible of a volcano to form an eruption is not farfetched. But Hamilton also refers the large amounts of water which were erupted in 1631. Alwyn Scarth points out though that "the events of 1631 eruption have been misinterpreted perhaps more seriously than those of any other great eruption in the history of Vesuvius" (*Vesuvius* 136). Accounts claim that mud, water, and lava came from the mountain, where more recent analyses have uncovered evidence of superheated clouds of ash and rock, called pyroclastic flows, rather than mud flows, known as lahars. Hamilton was operating off of the latter assumption, and even connects his analysis with the 1631 eruption and the interaction of water and fire. Yet Hamilton is also developing a fire-based system too; while observing a smoke column, Hamilton assumes that more lava will follow soon after, but "as no lava has appeared after this column of black smoak [*sic*], which must have been occasioned by some inward operation of fire; I apt to think, that the lava, which should naturally have followed this symptom, has broke its way into some deeper cavern, where it is silently brooding future mischief" (W. Hamilton 39). He predicts more lava will come from the volcano soon anyway, because of the black smoke. Vesuvius does not erupt though: its next eruption would not start until 1770 ("Vesuvius"). Still, Hamilton's focus here is on an "inward operation of fire" not fermentation. None of these theories are mutually exclusive but Hamilton's interpretations show that scientific views were not classifiable

into clear-cut sides. He would eventually completely refute the chemical theory of volcanism. But for the moment, his theories about volcanic action and causation were still fluctuating between incidental and systematic.

Unlike the first two letters, Hamilton's third, from October 1768, is not in direct response to an eruption. After the explosive eruptions that Hamilton had faithfully recorded, Vesuvius was quiet. Hamilton decides to collect eruption accounts from locals, or at least that is what he says he is going to do. Instead, Hamilton launches into a purely theoretic discussion of volcanoes. First Hamilton notes that "it would take many years close application, to give a proper and truly philosophical account of the Volcanoes in the neighbourhood of Naples" (W. Hamilton 47). He is hedging here by revealing that his account of course is not philosophical because it lacks the time that would be required to make it so. The hedging allows Hamilton to finish his thought: "but I am sure such a history might be given, supported by demonstration, as would destroy every system hitherto given upon this subject" (W. Hamilton 47). Effectively, Hamilton has said that every other natural philosopher is wrong about volcanoes. In Hamilton's theory volcanoes are central because they have the power to completely re-write current understandings of the world. Up until this point, it was apparent the Hamilton believed that volcanoes were interesting, but now Hamilton says they are central. Hamilton is starting to view the volcanoes and the earth systematically.

Naples, Hamilton says, is the perfect place to study volcanoes because so many kinds of volcanoes, from the youngest to the oldest, are there (W. Hamilton 47). Hamilton lists out all of these phenomena, like the Lake of Agnano and its fumes, the

volcanic island of Ischia, or the caldera of Solfaterra[2] as examples. He examines strata from his house's well as it is being dug and the excavations of Pompeii and uses this evidence to argue that both Ischia and Vesuvius "rose out of the sea" (W. Hamilton 48). Hamilton even purposes an expedition to Monte Nuovo to examine strata and its growth because he believes that it will be analogous to Vesuvius (W. Hamilton 51). All of which leads to Hamilton's final thought "Upon the whole, if I was to establish a system, it would be, that *Mountains are produced by Volcanos, and not Volcanos by Mountains*" (W. Hamilton 52). The emphasis is Hamilton's as he argues for a completely plutonic understanding of volcanoes. The statement goes a bit further than the earlier one in the letter, centering mountain-building upon volcanoes. If volcanoes build mountains, then volcanoes are far more important than previous thought, as mountains provide a variety of benefits to human development. Amusingly, Hamilton ends the letter there with "I fear I have tired you: but the subject of Volcanoes is so favourite a one with me, that it has led me on I know not how" (W. Hamilton 52). Blaming the volcano for his thinking is certainly an unexpected choice, but Hamilton is trying to reduce the impact of his earlier comments given their radical nature. Hamilton is slowly developing a new view of volcanology that sees volcanoes as an essential part of a complex system.

The fourth letter, from October 1769, is a side trip which deals with Hamilton's journey to Sicily and Mount Etna. He goes there to further compare Etna and Vesuvius, and does so with all of the tactics that he has utilized in the previous letters: drawings, hiking upon the volcano, measurements, and historical accounts. Early on, Hamilton

[2] Now called the Phlegraean Fields.

identifies his thesis that Vesuvius was created through igneous action "I am, in my own mind, well convinced that the whole of it has been formed by explosion" (W. Hamilton 55) and that all of the Campanian volcanic arc had been formed that way. Therefore Etna, too, would show those developments (W. Hamilton 56). Hamilton's argument is part of the nascent uniformitarian theory that would be founded by James Hutton and refined by Charles Lyell. The idea that all volcanoes are similar further systematizes them and makes the earth more dynamic, because it means that operations which happened in the past might also happen in the future. Hamilton expands by saying that "the operations of Nature are slow: great eruptions do not frequently happen; each flatters himself it will not happen in his time, or, if it should, that his tutelary saint will turn away the destructive lava" (W. Hamilton 59). Two ideas are here: first that nature operates outside of human time, a new kind of idea, one that would be completed by Hutton; and the other idea is that human superstitions are useless in the face of uncaring nature. While Hamilton is primarily interested in the mechanism of volcanoes, he never forgets that these volcanoes are surrounded by people, people that Hamilton believes need to remember that nature controls them more than any other force.

Like Vesuvius, Etna also erupted between 1764 and 1766 ("Etna"). Hamilton has the opportunity to observe one of the lava flows and the mountain that it came from, which was not the main cone of Etna. Hamilton says of this sub-cone, "the mountain raised by this eruption abounds with Sulphur and salts, exactly resembling those of Vesuvius" (W. Hamilton 70). The mountain that Hamilton is referring to is Monte Calcarazzi, a cinder or pyroclastic cone of Etna that erupted in 1766 ("Etna"). Cinder

cones are smaller volcanic phenomena that can occur separately or as part of a larger volcano. Composite volcanoes, like Vesuvius and Etna, often have other vents beyond their main vent "Subsidiary vents, commonly called satellite, parasitic, or flank vents, are common features at many composite volcanoes. […] These subsidiary vents are typically in the form of small monogenetic volcanoes like cinder cones or domes" (Davidson and De Silva 674). As Davidson and De Silva point out, these features can turn into cinder cones, which happened with Monte Calcarazzi. Importantly here, Hamilton describes the mountain as being raised, growing from the land up, rather than being formed otherwise. While considering Monte Calcarazzi and the other cinder cones around him, Hamilton says "All however have been evidently raised by explosion; and I believe, upon examination, many of the whimsical shapes of mountains in other parts of the world would prove to have been occasioned by the same natural operations" (W. Hamilton 76). While Hamilton's bias throughout the letters is too see more and more features as volcanic, he is furthering the thread of uniform geologic process. Hamilton concludes his argument, saying that there is "nothing on Mount Etna that Vesuvius does not produce" (W. Hamilton 84) to strengthen the idea of volcanic uniformity. These four letters provide a foundation for Hamilton, allowing him to outline to the Royal Society his theory of volcanoes.

In the fifth letter, from October 1770, Hamilton describes his own theory of volcanoes. Vesuvius resumed erupting between 1770 and 1779 ("Vesuvius") but that letter does not start off by noting any eruption or particular activity. Instead Hamilton refers to a map that he is including and very quickly lays out his thesis: that all the area

around Naples is “wholly and totally the production of subterraneous fires” (W. Hamilton 91). Hamilton’s statement offers a sharp contrast to the way that he started his first letter. He obviously feels that after six years of volcanic study he has enough authority to speak on how the land was formed. Hamilton’s theory of volcano formation is that subterranean fires slowly throw up more and materials, until these mountains emerged from the sea, then some of these mountains turned into volcanoes, and produced more material that connected the various mountain ranges (W. Hamilton 91). This theory is in direct opposition to most of the other claims about volcanoes, especially the chemical and the Neptunist theories of volcanoes. Hamilton acknowledges this: “I dare say, after a careful examination, most mountains that are, or have been Volcanos, would be found to owe their existence to subterraneous fire; the direct reverse of what I find the commonly received opinion” (W. Hamilton 92). For Hamilton, the reason behind the discrepancy is one of methods and philosophy. Hamilton believes that the methods that are employed by natural philosophers are not observational enough and that they misunderstand the amount of time geological changes take. Hamilton says

> Nature, though varied, is certainly in general uniform in her operations; and I cannot conceive that two such considerable Volcanos as Etna and Vesuvius should have been formed otherwise than every other considerable Volcano of the known world. I do not wonder that so little progress has been made in the improvement of natural history, and particularly in the branch of it which regards the theory of earth; Nature acts slowly, it is difficult to catch her in the fact. Those who have made this subject their study have, without scruple, undertaken at once, to write the natural history of a whole province, or of an entire continent; not reflecting, that the longest life of man scarcely affords him time to give a perfect one of the smallest insect. (W. Hamilton 92-93)

Hamilton criticizes other natural philosophers for not examining wider sets of evidence, saying that field of geology has not advanced because its researchers were misunderstanding the time scale of their subject. He notes that an individual's life is barely long enough to make sense of an insect's life, let alone mountain ranges and continents. Hamilton was not the only writer to see time in volcanoes; Cian Duffy notes that Patrick Brydone likewise saw the vast scale that volcanoes operated on (Duffy 79). But Hamilton was one of the first, especially for geology. Nature, as Hamilton posits, is both slow and uniform, and to understand volcanoes one needs to recognize the system they are part of and the time it takes them to operate.

To prove his claims, Hamilton refers to the various kinds of volcanic phenomena throughout Naples (W. Hamilton 93), the layering of the volcanic strata (W. Hamilton 99), and the lack of certain elements like fish fossils (W. Hamilton 116). Hamilton's goal is to show that volcanoes are the product of subterranean forces, not merely surface level reactions. To further this Hamilton uses both earthquakes and volcanoes. He believes the two are causally linked, and the expanse and depth of their violence to prove his point and disprove other natural philosophers:

> The earthquakes having been sensibly felt at a great distance from the spot where the opening was made, proves clearly, that the subterraneous fire was at a great depth below the surface of the plain; it is as clear that those earthquakes, and the explosion, proceeded from the same cause, the former having ceased upon the appearance of the latter. Does not this circumstance evidently contradict the system of M. Buffon, and of all the natural historians, who have placed the seat of the fire of Volcanos towards the center, or near the summit of the mountains, which they suppose to furnish the matter emitted? Did the matter which proceeds from a Volcano in an eruption come from so inconsiderable a depth as they imagine, that part of the mountain situated above their supposed seat of the fire must necessarily be destroyed, or dissipated in a very short

> time: on the contrary, an eruption usually adds to the height and bulk of a Volcano; and who, that has had an opportunity of making observations on Volcanos does not know, that the matter they have emitted for many ages, in lavas, ashes, smoke, &c. could it be collected together, would more that suffice to form three such mountains as the simple cone or mountain of the existing Volcano? (W. Hamilton 142-43)

Hamilton notes that earthquakes are felt a great distance away from their epicenter. He uses a quick analogy to say that if earthquakes act that way, then volcanoes must too. Hamilton supports this opinion by noting volcanoes produce too much matter during their eruptions for the fuel sources to be located near the top or base of the mountain, if that were the case the mountain would collapse (W. Hamilton 143-44). The theory sees volcanoes as part of a system of causal forces within the earth, not a fire on top of a mountain. As Cope notes, Hamilton weaves subterranean features together, his writing "problematizes, extends, and interrelates underground formation: caves can result from earthquakes, earthquakes can trigger volcanoes, volcanic craters can be deemed elevated" (Cope 308). Hamilton even references Buffon who was a proponent of the chemical theory of volcanoes. Hamilton argues there is not enough evidence to show that volcanoes are merely the result of a coal and sulfur fire. He claims that volcanoes are long acting, integrally connected part of earth's systems.

Hamilton's theory of volcanoes does not merely stop at considering the volcanoes as they relate to the Earth. He also relates volcanoes to humanity, an idea that he started in the first letter. Hamilton says of volcanoes, "Such wonderful operations of Nature are certainly intended by all-wise Providence for some great purpose. They are not confined to any one part of the globe, for there are Volcanos existing in the four quarters of it. We see the great fertility of the soil thrown up by explosion" (W. Hamilton 160). Hamilton's

claims are an interesting addition to the idea of the volcano, especially given Hamilton's disdain for the superstitions of Neapolitans. Hamilton names Providence, an iteration of the Christian God, as the author of this system. So even though Hamilton seems to doubt that images of saints will stop a lava flow, he does believe that volcanoes are part of an overall plan. Hamilton continues this line of thought a little later by asking "May not subterraneous fire be considered as the great plough (if I may be allowed the expression) which Nature makes use of to turn up the bowels of the earth, and afford us fresh fields to work upon, whilst we are exhausting those we are actually in possession of, by the frequent crops we draw from them?" (W. Hamilton 161). His vision of a constant cycle of earth, being formed, eroded, consumed, and then re-erupted is very similar to the twenty-first century version of the rock cycle, the difference is though that Hamilton adds a deistic agency to the process. Regardless of Hamilton's anthropocentric view of volcanic action, he is strengthening the environmental ties between human societies and volcanoes, suggesting that volcanoes affect the ways that people live.

Over the course of the letters, Hamilton develops a more systematic way of thinking about volcanoes. Many people have noted Hamilton's contributions to science despite his lack of training. For example, Sleep emphasizes that not only did Hamilton help record the facts "in a pure Baconian way" but also managed to free volcanoes from the "metaphysical beliefs" that were placed over them (Sleep 323). The account of the letters above though shows that Hamilton was not completely Baconian or completely opposed to metaphysics, which turns out to be good for scientific discovery. Had Hamilton only reported data, he would never have launched the assault on the ideas of the

Neptunists and never would have helped either Hutton or Lyell in their works. Hamilton's theorizing allowed him to see Vesuvius stretching into the earth, drawing on vast reserves of molten rock, melted by a subterranean fire to create mountains and mountain ranges. And Hamilton could see this action taking place over a span of years beyond one human life or the record of human history. *Observations on Mount Vesuvius, Mount Etna, and other volcanos* was vitally important as a foundation for the development of a systematic view of volcanoes, both in the ways that volcanoes exist in time but also the ways that they interrupt and affect human civilization. Hamilton's work helped define deep time, systemized volcanoes, and established connections between human development and volcanic eruptions. His theories set the tone for not only the field of volcanology but also the status of volcanoes in culture. Even though Hamilton's observations were some of the most important of the time, they did not dictate volcanic fact. Other writers, like Hester Piozzi, encountered and pondered Vesuvius further defining the volcano's features.

2. Hester Piozzi

Hester Lynch Piozzi (1741–1821), born Hester Lynch Salusbury, was also a visitor to Naples in the late eighteenth century who like Hamilton started to consider deep time and the impact of volcanic eruptions on human society. Piozzi was born into a well-connected Welsh family who made sure that she was educated, including learning "philosophy, rhetoric, and Latin" (M. Franklin). Unfortunately, Piozzi's family was

frequently in financial trouble, which meant that she was forced into a marriage of convenience with brewer Henry Thrale in 1763. Piozzi's marriage to Henry was "a loveless match which deeply embittered Hester. She also resented the endless pregnancies, thirteen between 1764 and 1778, producing twelve children, only four of whom survived to maturity" (M. Franklin). Fortunately for Piozzi, it was through her husband that she met Samuel Johnson. Their friendship is one of the most famous in literature, and it resulted in the well-received *Anecdotes of the Late Samuel Johnson* (1786) by Piozzi which "sold out on the first day of publication" (M. Franklin). Henry died in 1781. Piozzi was then able to sell off her former husband's assets, and determine her own life. She met an Italian musician, Gabriel Mario Piozzi, a Catholic who had been the music teacher to her children, and fell in love with him. They married in 1784 despite religious and class opposition from all corners, including her own daughter and Samuel Johnson (M. Franklin). Piozzi traveled throughout Europe with Gabriel, and her record of that journey became the travelogue that this chapter will focus on. An obituary foregrounds Piozzi's friendships to Johnson and others like Sir Joshua Reynolds and Lady Mary Wortley Montagu, but also notes "the vivacity of this lamented Lady's mind was a never-failing source of pleasure to all who had the good fortune to enjoy her society; while the brilliancy of her wit, tempered by invariable good humour, and general benevolence, delighted all who approached her, and offended none" ("Death of Mrs. Piozzi"). Piozzi was not merely a pleasant, well-connected woman; she was a strong writer who experimented with a variety of forms in an effort to convey experience and emotion to her audience.

Piozzi's *Observations and Reflections Made in the Course of a Journey Through France, Italy and Germany* was published in 1789. *The Observations and Reflections* became a bestseller (D'Ezio 167) but "public reception of Observations and Reflections was, at the very least, mixed" ("Strange Farrago …" 206). While the public might have enjoyed the text, there was no critical acclaim. Piozzi's text is not a standard travel diary nor a fictional narrative; the genre is a mix which Piozzi uses to covey the sensations of the travel that she wants. D'Ezio argues that Piozzi's presentation of the Grand Tour is a "more sensual experience" than other travelogues of the era (D'Ezio 166). D'Ezio states that in Piozzi's account "Sensations and feelings are exploited as emotional filters, to which corresponds a specific 'code' of writing, that of a spontaneous flow of observations and personal reflections on Italy, enhanced by the rhetoric of 'on-the-spot composition' that involves the reader with its sense of immediacy and expectation" (D'Ezio 166). Dougal concurs, saying that the "primary agendas throughout *Observations and Reflections* is to create a sense of immediacy" ("Strange Farrago …" 209). The sense of immediacy is important to the travelogue as it heightens the aesthetic description of the volcanoes that Piozzi experiences, affecting the reader more than empirical descriptions, like Hamilton's, might.

Piozzi knew that her travelogue was different. In her preface she says, in defiance to the standard travelogue, that she wants to represent reality, "for the book – I have not thrown my thoughts into the form of private letters; because a work of which truth is the best recommendation, should not above all others begin with a lie" (Piozzi 1: vi). Piozzi is trying to minimize her audience's potential confusion by noting the text does not fit

convention. She notes that were to try to make the text fit the convention, it would diminish the truthfulness of the work. Piozzi still places her work near convention, "that I should make some reflections, or write down some observations, in the course of a long journey, is not strange; that I should present them before the Public is I hope not too daring" (Piozzi 1: iv). She goes on to say that it is because the public favors her so that she is publishing the travel journals, and if their publication is unwarranted she will know by a cold reception for the work. The travelogue is quite different, with chapters divided up by location, rather than by dated letters, with time moving fluidly between events and observations. Most of this section will focus on volume two, especially the first entry, on Naples. That being said, the first volume is not devoid of volcanoes.

Volume one details Piozzi's journeys from Calais to Paris, to Lyon, and then into Northern Italy. Piozzi travels throughout Northern Italy, with the first volume ending in Rome. The first volume contains no active volcanism. Volcanoes still manage to sneak in though. While in Tuscany, Piozzi stops at Radicofani: "The first sleeping place between Sienna and this capital shall not escape mentioning; its name is Radicofani, its title an inn, and its situation the summit of an exhausted volcano" (Piozzi 1: 377). Piozzi is referring to Mount Amiata, an apparently dormant[3] volcanic system, which has no recorded eruptions in human history ("Amiata"). The dormant volcano is particularly striking to Piozzi. Looking upon it, she says: "Such a place did I never see" (Piozzi 1: 377). This seven-word sentence is evocative, especially because of its parsimony. Many

[3] The word "dormant" is used here instead of "extinct" because even though the volcano had its last "major eruptive episode about 300,000 years ago" the area around it is still thermally active ("Amiata"). Even though it is apparently quiet by human standards, the possibility that it might erupt exists.

of Piozzi's other sentences are quite long, yoked together with semi-colons. This sentence though is direct and stark. The lack of description pushes home the idea that the scene is unique and beyond belief. The volcano has grabbed Piozzi's focus in a manner that to convey her sensation she chooses less description rather than more, suggesting a degree of sublimity.

Piozzi eventually does describe the blasted volcano. She elects to do so in a gothic fashion: "The violence of the mountain, when living, has split it in a variety of places, and driven it to a breadth of base beyond credibility, its height being no longer formidable. Whichever way you turn your eyes, nothing but portions of this black rock appear therefore; so here is extent without sublimity, and here is terror mingled with disgust" (Piozzi 1: 377). The first feature of the volcano that Piozzi recognizes is its violence, violence so incredible that it has rent the mountain in multiple places. The violence has spread the mountain out throughout the valley to an area that strains comprehension, even though the mountain itself is no longer that tall, creating a sublime scene. David McCallam notes that the volcano was an established feature of the sublime in the eighteenth century (McCallam 53). Duffy argues that volcanoes in the eighteen century were connected with the sublime because of the nature of their depth and their eruptions (Duffy 69). But Piozzi rejects the sublime in the next sentence. Instead she focuses on the grotesque, the layers of ancient black lava that remind her of the incredible violence of years past. And all this description for what Piozzi describes as an "exhausted" volcano. The description of Amiata here will resonate with Piozzi's later discussions of Vesuvius. In fact, she seems honestly disconcerted by the experience

saying “To this truly dismal reposing place is however kindly added a little chapel; and few persons can imagine what a comfortable feel it gave me on entering it in the morning after hearing the winds howl all night in the black mountain” (Piozzi 1: 378). Going to the chapel helps Piozzi reorient herself after spending the night in the inn on the dormant volcano. The episode demonstrates a few ideas: first that Piozzi goes to the chapel reinforces the idea that nature was inferior to God, and that Piozzi was able to find relief from the violence of the landscape in her faith, in her belief that she would be able to transcend the world. Similarly, Piozzi also demonstrates an impressive ability to imagine a fragment of geologic time. She is unsettled by a volcanic field which is not an everyday experience. Piozzi aesthetically constructs geologic time in this vignette. That she seeks relief speaks to the potential for a human understanding of geologic timescales but also the very difficult and unsettling nature which comes with such an understanding.

The night spent at Radicofani is the most important piece of evidence from volume one, although there are a few other volcanic references. Vesuvius makes a minor appearance in the first volume, as the Bolognese entertain the visiting King of Naples with “representation of Mount Vesuvius” (Piozzi 1: 266). Piozzi comments that entertaining the king in such a fashion is “odd” which seems a fair assessment; using the most destructive part of a country as entertainment for the representative of said country seems a bit tone deaf. Although using catastrophes as entertainment is certainly not unique. Piozzi’s distaste suggests that she is not able to put aside any potential suffering that a Neapolitan might suffer during the eruption of Vesuvius. The other reference to volcanoes comes just a bit later.

When Piozzi is in Florence, right after Bologna, she takes the opportunity to consider the various mountain ranges around there, including the Alps and Apennines. She labels the Apennines “aquatick” and the Alps “volcanic.” Her evidence, derived from philosophers, is that the Apennines are more rounded and have horizontal strata, where the Alps are more pointed, have no horizontal strata, and no “petrifactions [fossils] contained in them” (Piozzi 1: 269). Piozzi gathered her data from William Parson’s *A Poetical Tour, in the Years 1784, 1785, and 1786* (1787). She includes a pair of couplets from Parson’s poem that describe a Neptunist version of Apennine mountain building:

> Here the tracts around display
> How impetuous ocean's sway
> Once with wasteful fury spread
> The wild waves o’er each mountain's head. (Piozzi 1: 269, Parsons 95)

In the poem, Parson includes a long footnote to accompany his couplets. He lists off the same points that Piozzi does, noting that the Alps are “devoid either of horizontal strata or petrifactions” and thus have never been covered by the ocean (Parsons 95). The poem and Piozzi’s use of it suggests that she believed in both the Neptunist and Plutonist theories. Piozzi follows these couplets up with a brief digression on the sensations that the mountains cause, claiming that Roche Melon, also called Rocciamelone, in Piedmont causes different sensations than the Apennines. Piozzi combines geologic theories with affective ones. The mountains were not just built, but they also evoke feeling, a more tangible point of reference for her readers. After these mountain-building speculations and discussions of sensation, Piozzi makes note of Hamilton and his knowledge of geology “Sir William Hamilton, however, is the man to be referred to in all these matters; no man has examined the peculiar properties and general nature of mountains, those

which vomit fire in particular, with half as much application, inspired by half as much genius, as he has done" (Piozzi 1: 270). Hamilton does claim that all mountains might be volcanoes (W. Hamilton 52). Further Piozzi's comments show that she knows Hamilton and that Hamilton was fairly well known for him to be the go-to natural philosopher for mountain-building. Beyond that volcanoes are not especially foregrounded in the first volume, but the few mentions that do occur are quite valuable to understanding how Piozzi thought about volcanoes and her own knowledge of volcanic research. The second volume focuses a great deal more on volcanoes, as the first entry is in Naples.

Volume two begins with Piozzi's approach to Naples, which was a frightful one: "and sure the providence of God preserved us […]; thunder, lightning, storm at sea, rain and wind, contending for mastery, and combining to extinguish the torches bought to light us the last stage: Vesuvius, vomiting fire, and pouring torrents of red hot lava down its sides, was the only object visible" (Piozzi 2: 1). Piozzi, like Hamilton early on in his report (W. Hamilton 2), seems to be drawing a tacit connection between volcanoes and bad weather. Whatever the case may be, Piozzi's approach is quite graphic, with the storm lashing the land and Vesuvius an infernal beacon vomiting torrents of molten rock into the black night. Vesuvius was erupting again between 1783 and 1794 ("Vesuvius") providing Piozzi with a spectacular scene, an experience for her readers not to be missed. Her description does reinforce the idea of the horrendousness of volcanoes, like with Amiata. Volcanoes, thus far in the text, are locations of violence and terror, not beauty as Hamilton suggests. Piozzi contrasts her first view of Vesuvius with a conversation she had earlier on the trip.

Piozzi had asked a Franciscan friar, before her entry into Naples, whether or not a mountain in the distance was in fact Vesuvius. In response, the friar quips "that's our mountain, which throws up money for us, by calling foreigners to see the extraordinary effects of so surprising a phænomenon" (Piozzi 2: 2). The friar's sharp sense of humor aside, it is not surprising that Vesuvius was so popular. Vesuvius was one of the few consistently active volcanoes in Europe, erupting seventeen times between 1600 and 1800 ("Vesuvius"), and did not require sailing to get to, like Etna. Volcanic tourism, while starting with Vesuvius, became much more wide spread later in the century, a fact which will be discussed at greater length in chapter three. That a volcano, not its eruptions, influences human economic exchanges shows that volcanoes were objects of fascination in the late eighteenth century. Vesuvian tourism was already a boon to the Neapolitan economic in the eighteenth century and would continue to be so.

Piozzi continues her description, mentioning that lava flows and lighting were the only sources of illumination as they move towards the city. When they reach Naples, Piozzi comments "Nothing sure was ever more sublime or awful than our entrance into Naples at the dead hour we arrived" (Piozzi 2: 2) ascribing a degree of existential terror to the volcano and the weather, both beyond comprehension and dreadful, picturing Vesuvius as part of the sublime. Piozzi's French valet even says as much to her, "'*Ah, Madame! il me semble que nous sommes venus icy expres pour voir la fin du monde**' […] * Lord, Madam! why we came here on purpose sure to see the end of the world" (Piozzi 2: 3). The valet, thanks to the volcano, thinks that the world could be undergoing an apocalyptic transformation. Presumably the valet does not actually think that the world

is coming to an end, but the connection is not an extreme one. Both Piozzi and her valet show just how shocking an erupting volcano can appear; they feel small next to it, insignificant or like the world has decided to end their existence. The volcano retains its apocalyptic significance even in the face of advancing scientific knowledge. Eventually though, Piozzi gets to rest and the world-ending storm passes over Naples.

In the next paragraph Piozzi begins to discuss the sights of Naples. Very quickly she notes that "one need not stir out to look for wonders sure, while this amazing mountain continues to exhibit such various scenes of sublimity and beauty at exactly the distance one would chuse to observe it from; a distance which almost admits examination and certainly excludes immediate fear" (Piozzi 2: 4). First, Piozzi describes Vesuvius as beautiful and sublime, the exact opposite of Amiata which was not sublime but disgusting, despite the fact that Vesuvius is erupting and Amiata was quiet. For Piozzi, volcanoes seem to gain beauty when they are active. That being said, Piozzi does admit that Vesuvius inspires fear, an aspect of the sublime. But she is far enough away that the fear is not related to injury or harm in the short term, rather the existential fear of being near a volcano. The lack of immediate fear allows Piozzi to examine the volcano. Piozzi's use of the word examination also seems to show a developing understanding of volcanoes as objects of empirical investigation not superstition, a trend noticeable with Hamilton too.

Despite the transition of the volcano from object of superstition to one of inquiry, Vesuvius causes Piozzi concern keeping her awake at night "When in the silent night, however, one listens to its groaning; while hollow sighs, as of gigantic sorrow, are often

heard distinctly in my apartment; nothing can surpass one's sensations of amazement, except the consciousness that custom will abate their keenness" (Piozzi 2: 4-5). The use of sound highlights the pervasive nature of the volcano: even though Piozzi cannot see Vesuvius, its sounds remind her of its presence. She believes that only through repeat exposure would such noise stop bothering her. As with Amiata, Vesuvius disturbs Piozzi, although not for the same reasons. Amiata was disturbing because of the violence it showed. Vesuvius seems to entrap Piozzi because of its sublimity and anthropomorphized sorrow. She even seems unhappy that eventually Vesuvius's groans will not affect her in the same fashion as they did, that the keenness of the sublime will wane. She continues,

> I have not, however, yet learned to lie quiet, when columns of flame, high as the mountain's self, shoot from its crater into the clear atmosphere with a loud and violent noise; nor shall I ever forget the scene it presented one day to my astonished eyes, while a thick cloud, charged heavily with electric matter, passing over, met the fiery explosion by mere chance, and went off in such a manner as effectually baffles all verbal description. (Piozzi 2: 5)

What Piozzi describes here is a unique natural phenomenon: the collision of a thunder cloud with the smoke coming off of the volcano. It may be possible that a thundercloud collided with an ash plume, but more likely the ash plume just developed to the point where it was generating its own lightning. Hamilton noted the connection between eruptions and electricity (W. Hamilton 163). According to Mather and Harrison, there are five different theories that explain the lightning within ash plumes (Mather and Harrison 413-16) and ample evidence for lightning within ash plumes throughout history (Mather and Harrison 394-97). Amusingly, because the event is beyond description for Piozzi it is difficult to know what happened, whether it was the innately charged quality of the ash

plume which caused the discharge, or a collision; whether it was a thunder clap that Piozzi heard or the eruption itself; or some combination of the preceding options. The description though reinforces the sublime nature of volcanoes because the event is difficult to describe completely. The continued eruptions disrupt Piozzi's ability to function normally, as she is overwhelmed by their spectacle. After these initial descriptions, Piozzi lets go of Vesuvius and focuses on other aspects of Naples, like the architecture, people, and culture. She continues to make reference to the volcano here and there, including writing a poem, but the focus remains on the human features of Naples. That is, until she visits the ruins.

Piozzi takes the time while in Naples to visit ruins of Herculaneum and Pompeii, a popular Grand Tour activity (*Vesuvius* 227). Piozzi's consideration of the ruins shows her ability to think about the inhabiting a world with volcanoes and continues to show her ability to recognize a geologic time scale. She starts off the section with a contrast between the human and volcanic: "a theatre, the scene of gaiety and pleasure, overwhelmed by torrents of liquid fire" (Piozzi 2: 34-35). The description of lava as liquid fire subtracts the rock element from lava, focusing instead on the chemical reaction that is fire. Hamilton only uses the phrase once in his work (W. Hamilton 30). Piozzi could be exaggerating, but her description might be influenced by a chemical understanding of volcanoes. Even if Piozzi has a different understanding of the nature of lava or the destruction of the towns, she certainly has a unique perspective on the devastation focused not solely on the tragedy but also on the preparedness of the towns and the potential for future violence. She criticizes the ancient denizens of the town

saying “Where that very town indeed was built with the lava produced by former eruptions, one would think it scarce possible that such calamities could be totally unexpected” (Piozzi 2: 35). Piozzi wonders why people would not notice the built up layers of igneous rock, connect those rocks with volcanic action, and therefore recognize their own danger. This rhetorical question shows Piozzi’s capacity for long term thinking. In the defense of the residents of Pompeii and Herculaneum, there was a three-hundred year gap between the eruption in 79 CE and the next earliest eruption in 217 BCE (“Vesuvius”). But the ancient Greek philosophers were not ignorant of Vesuvius’s history: both Strabo and Diodorus Siculus noted Vesuvius’s igneous origin, even if Pliny the Elder did not (*Vesuvius* 40-41). But neither suggested that it might erupt again. The Romans at Pompeii and Herculaneum and the Neapolitans at Portici show a failure of long-term thinking, something that Piozzi demonstrates easily. She though takes a somewhat more fatalistic view on the situation. Piozzi finishes her thoughts on whether the tragedy was preventable by saying “but no matter, life must go on, though we all know death is coming” (Piozzi 2: 35). Piozzi’s statement suggests that she believes that life is merely a transitional state, in which case volcanoes are merely a pain of the world to be avoided.

Then Piozzi ventures into a very complex set of ideas about living near a volcano, saying “how *very* horrible the certainty, that such a scene may be all acted over again to-morrow; and that we, who to-day are spectators, may become spectacles to travellers of a succeeding century” (Piozzi 2: 35). The degree of empathy Piozzi has for the dead of those ancient cities is remarkable. Her connection between lives of the dead with her own

again speaks to long-term thinking: she recognizes that people continue to live around Vesuvius, at the whim of Vesuvius, not the other way around. She even notes that a destructive eruption of Vesuvius is a "certainty" not a possibility. The main fear that Piozzi seems to have is not death itself but that she might become a spectacle for those future visitors. Piozzi is disturbed by the idea of becoming an unwilling object of entertainment. Her ability to empathize with fallen Romans helps her readers see a fragment of geologic time, what Hamilton emphasized as key to understanding volcanoes. While visiting Pompeii she sees a Frenchman take a human bone from the ruins. Piozzi chastises him for taking it, and says that she hopes that he has picked up the remains of a Gaulish solider instead of a Roman one (Piozzi 2: 35), so that he might think about what he has done when he opens his collecting cabinet. Piozzi does not believe that time should limit one's feelings for the fallen. Beyond showing respect for the tortured dead, Piozzi's visit to Herculaneum and Pompeii further shows the ways that she is capable of thinking about the expanded time scales that volcanoes require.

During her three-month stay, Piozzi also hikes to the summit of Vesuvius (Piozzi 2: 61). While the visit to Pompeii and Vesuvius might have been cultural, a feature of the Grand Tour (*Vesuvius* 227), the hike is described in more scientific terminology. Piozzi says that they are going to "inspect" the volcano even though it seems in poor taste to turn the "eyes of examination" on "the favourite alembic of nature" while it is in process (Piozzi 2: 61). Despite the fact that nature's mechanisms are also placed in scientific terms, Piozzi says that it is inappropriate to view the changes in action, that scientific sight is intrusive. The connection between volcanoes and chemistry is furthered with the

use of "alembic" as a way to describe what is occurring in the volcano, a theory that Piozzi has already demonstrated she knows. The chemical theory of volcanoes, while not wrong, does limit the systematic connections that can be made between a volcano and the environment. If volcanoes are collections of chemicals, then the relationship between the earth and the volcano is not causal, merely incidental. And Piozzi's descriptions of the volcanoes are often not systematic: Vesuvius seems to be unique in Piozzi's world or disconnected from any the rest of the operations of the planet. The disconnect could be just a question of genre or of location, but regardless there are no obvious systematic linkages in Piozzi's text between Vesuvius and igneous action as there was in Hamilton's work.

While on the mountain, Piozzi sees flowing lava, and notes how it moves and cools "now the lava is less rapid, and stiffens as it flows; stiffens too in ridges very surprisingly, and gains an odd aspect, not unlike the pasteboard waves representing sea" (Piozzi 2: 61-62). She does say that the lava was formerly a solid object, heated until it liquefied, suggesting a more Plutonic position. But she also notes that the lava is black because this particular batch from Vesuvius "has been mingled with coal" (Piozzi 2: 62). The lava had not been mingled with coal to change it color. Piozzi's mixed usage of scientific theories though is valuable to see because she helps show how contested ideas were about twenty years after Hamilton had published his letters. Debates about the nature of the earth were ongoing. Piozzi also notes Hamilton's courage investigating the mountain has become more of a topic than the volcano itself (Piozzi 2: 62). She comments on the situation briefly, but her comment also demonstrates how difficult

thinking about volcanoes can be. Hamilton himself would probably tell people to focus on Vesuvius and its features, rather than any bravery he showed. But Hamilton's accomplishments are easier to conceive of rather than the chasm of time that Vesuvius, Amiata, or Etna might fill. Geologic time is easy to skip over, especially when more recognizable human feats are on hand.

Presumably, Piozzi hikes to the top of Vesuvius, but she never says so. Instead she cryptically and correctly states "That the situation of the crater changed in this last eruption is of little consequence; it will change and change again I suppose" (Piozzi 2: 64). That is her last description of the crater of Vesuvius. There is no breathless description of the smoldering infernal pit, the sublime aspect of the fires, or anything. Piozzi turns her discussion toward the astonishment she feels that more visitors and tour guides are not killed by looking into the crater, highlighting her concern for human life again. Then the topic is dropped altogether as she moves on to a different, non-volcanic thought. The abrupt change is not unique to Piozzi's writing in *Observations and Reflections*: throughout the travel journal she switches topics whenever it suits her. The absence of Piozzi's description of the crater seems to suggest that it was not so spectacular that she either wanted or remembered to record it. For Piozzi distance seems to be important for her experiences of Vesuvius and that perhaps moving in too close failed to cause any particular sensation. Despite the lack of a description of Vesuvius's crater, Piozzi says that it was the volcano, and volcanism in general, that she would remember the most from her stay in Naples.

As Piozzi is about to leave Naples, she notes that she has experienced a wide variety of Neapolitan life. She says that art "will fade from one's remembrance, and leave the glow of and the gloom of Posilippo indelibly impressed. Vesuvius too! that terrified me so when first we drove into this amazing town, what future images can ever obliterate the thrilling sensations it at first occasioned?" (Piozzi 2: 86). Piozzi places natural scenes, and the volcano in particular highest in her memories. Beyond merely a listing of the "best of Naples," Piozzi says the sensations she had will not be obliterated or removed, that they have had a lasting effect upon her. She goes on to say that after her time in Naples she will have difficulty finding the same kind of delight in the future, because the mind that experiences "such sublime, such animated scenery, and experiences a sudden deprivation of delight, finding the bosom all at once unfurnished of what has yielded it for three swiftly-flown months, perpetual change of undecaying pleasures" (Piozzi 2: 86). For Piozzi the experiences with Vesuvius surpass others she has had. She does not quite believe she will ever be able to recapture them. In her travelogue there is relatively little devoted to Vesuvius out of eighty-six pages in Naples, but the pleasures of Vesuvius are the last thought that Piozzi offers on Naples.

Vesuvius moves through many different filters during Piozzi's account: starting off a sublime force of nature, the doom of Pompeii and Herculaneum causing the inhabitants to become spectacles, a mountain to climb, and then finally back to sublime terror. Piozzi has an important view of volcanoes, especially given how large her audience was. As her experiences with Amiata and her epiphanies in Herculaneum show, she writes about geologic time in an aesthetic fashion which helps her audience feel time,

what Hamilton said was so important for volcanic inquiry. Piozzi does not seem to identify the volcanoes as part of a system though, even though she met Hamilton (Constantine 143) and appears to have read Buffon (Eddy 56) placing her somewhere between the two geologic theories. But her lack of volcanic systemization only shows how contested ideas about the creation of the earth were. All complex paradigmatic shifts take time and are rarely accepted at first. Piozzi uses the aesthetic mode, the sublime, to place human life in a subordinate position to Vesuvius. As Teresa Barnard argues "the female poetic imagination, […] builds on and compliments the scientific deliberations of male travelers and scientists" (T. Barnard 34). Piozzi's account does as Barnard argues, taking a scientific object and combining it with an aesthetic one, creating a trigger for sensation and experience for her audience. Piozzi investigates and experiences Vesuvius through her writing. While *Observations and Reflections* might not outline the volcano's mechanisms, it does more important work conveying the sense of scale connected to volcanoes, how they reach through time to affect humanity at any point. Piozzi's and Hamilton's texts both give their readers understandings of volcanoes. *Observations and Reflections* is important because of the way that it aesthetically represented volcanic deep time through descriptions of Amiata and Vesuvius, and because Piozzi connected the effects of volcanism with human lives. The popularity of her work meant that a large number readers encountered geologic deep time in Piozzi's travelogue, helping them to reconsider the relationship between humanity and the earth. Piozzi helped introduce volcanoes to a wider range of readers due to the less restricted audience for her travelogue. Information about volcanoes was not restricted to just scientific works and

travelogues. Educational writers, like Priscilla Wakefield, helped prepare the next generation of writers to grasp the scope of volcanic action so that they could build off Hamilton's and Piozzi's work.

3. Priscilla Wakefield

Priscilla Wakefield (1751–1832) was an English writer of educational texts for women and children. A Quaker, she was educated by her mother and then taught her siblings (Shteir). In 1771 she married Edward Wakefield and had three children with him (Carlyle 455). Wakefield did not start writing until she was forty, when her family experienced financial difficulty. By 1798 she had managed to publish four books. According to Ann Shteir, Wakefield's success was thanks to the directness of her works: "Wakefield succeeded because she produced improving and didactic works of non-fiction that middle-class parents were choosing to buy. Unlike Romantic writings that celebrated imagination and fantasy Wakefield's books have a deliberate moral tone, are filled with information, and focus on real-life experiences in the present day" (Shteir). Wakefield's popularity is evident in the republication of her works: twelve of seventeen of her works entered at least a second edition, and many beyond that (Carlyle 456). Wakefield's works were motivated by her progressive leanings: she believed in education for all and was opposed to slavery and animal cruelty (Shteir). An obituary printed in *The Gentleman's Magazine* claims that Wakefield "In her efforts to improve the rising generation, by the publication of useful books for their perusal, she was eminently successful" (Urban 650).

In regards to scientific knowledge or natural history, Carlyle notes that "Mrs. Wakefield had considerable knowledge of botany and natural history" (Carlyle 456), and Shteir says that Wakefield's texts "are part of the Enlightenment history of disseminating science to new audiences" (Shteir). While not all of Wakefield's books were interested in science, they still did touch on scientific theories, such as one of her most popular works which charted the travels of a fictional family through Europe.

The Juvenile Travellers (1801) follows the adventures of the Seymour family. The travelogue is one of Wakefield's most popular works, reaching its nineteenth edition in 1850 (Shteir). The text was so popular that even in 1854, it was advertised as a one of a series of books "adapted for holiday presents" that included other renowned instructional writers like Maria Edgeworth ("Classified Ad 1 -- no Title" 16 April 1854). Initial reviews of *The Juvenile Travellers* were positive, complementing Wakefield's enthusiasm for education "We have had frequent occasion to comment on this Lady's zeal and ardour in the cause of youth" ("Advertisements & Notices" 11 March 1802). The reviewer even thought that Wakefield did not do enough in her first edition, and endorses the publication of further versions of *The Juvenile Travellers*: "we think the author has attempted to be rather too brief. We wish she would take notice of this hint, if another edition should be called for" ("Advertisements & Notices" 11 March 1802). The review goes on to say that the education of a child would be well worth the cost of an expanded book. Not all the reviews were glowing though: a critic in *The Monthly Magazine* was a bit incredulous about the ideas and questions that came from the "mouths of babes and sucklings" in the novel. The reviewer concedes that verisimilitude

aside “this work is certainly to be recommended on the score of the information which it communicates, and the interest it is likely to excite” (*Monthly Magazine* 601). Even those who found fault with Wakefield’s fictional children believed that the text had value for young readers.

Wakefield notes in the preface that “it is desirable that children, advanced beyond infancy, should be acquainted with the prominent features in the character and manners of the inhabitants of other countries; with their chief cities, and most celebrated buildings; and have a general idea of the face of nature in different climates” (Wakefield iii). Wakefield focuses on four general features that children should know: people, geography, architecture, and ecology. These features she believes will be the most beneficial to educating children about the world. Wakefield herself never travelled outside of Britain (“Teaching Conduct …” 299). Thus in the preface she names the travelers whose works she is using to construct her narrative “Brydone, Cox, Moore, Radcliffe, Southey, Thicknesse, and Swinburne” (Wakefield iv). The works of these travel writers provide Wakefield the material she needs to construct a true-to-life European tour in her text. Instead of using an abstracted eye that might dart from place to place, Wakefield invents a family, the amusingly named the Seymours.[4] The family is made up of Mr. and Mrs. Seymour and their children, Theodore, fourteen, and Laura, twelve. Through Wakefield’s narrative, not only would a reader learn facts, but also ways of thinking and knowing.

[4] The name sounds like ‘See more’ an apt name for tourists.

The Seymour family's journey is extensive. They travel through Denmark, Sweden, Prussia, Germany, Holland, Switzerland, Italy, Sicily, Spain, and France as the itinerary in the book shows (Wakefield 369-73). Concurrently another character, a friend of Laura's named Sophia, travels through Russia, the Ottoman Empire, and Greece while corresponding with Laura (Wakefield 373-74). Towards the end of text Theodore is swept away by a tidal wave caused by a volcanic eruption while the family is in Sicily. He survives, and manages to make his way back home from Constantinople and up through Eastern Europe (Wakefield 474). *The Juvenile Travellers* covers most of Europe with its narrative, not just the typical Grand Tour countries. The wide geographic reach of the text emphasizes Wakefield's desire that her readers learn more than just facts. As Hill notes, Wakefield is constantly reinforcing the importance of knowledge and the Seymour parents are always emphasizing "toleration, humanity, the avoidance of prejudice and bigotry" (Hill 8). Despite the gender parity of the text, Dougal argues that most of the travelogue reinforces separate roles for boys and girls in the education of the children. Only when Theodore is presumed dead does Laura get to be taught as if she were a boy. Although Theodore eventually resumes his role in the family, Wakefield subtly shows the similar capacities of the two genders ("Teaching Conduct …" 316-17). The text has substantial scope, and with more than three hundred pages in the first edition, *The Juvenile Travellers* engages with a whole range of natural and cultural features of Europe. Volcanoes enter *The Juvenile Travellers* when the family visit Vesuvius in chapter eighteen and Etna in chapter twenty-three and twenty-four.

Chapter eighteen details with the Seymour family's visit to Vesuvius, after they have spent a little time in Naples. The chapter starts off by locating and defining Vesuvius, saying that nearby Naples stands: "a volcano, or burning mountain, named Vesuvius; during the time of an eruption, which generally happens in the course of a few years, streams of liquid fire issue from the crater, or hollow summit of the mountain, and, descending down its sides, overwhelm and destroy the country through which they pass" (Wakefield 184). While Wakefield's introductory description is brief, it is also quite dense. Vesuvius is classified as a "burning mountain" which is a phrase utilized in the chemical theory of volcanoes, suggesting that the mountain is a self-contained chemical reaction, like the burning of coal. The term "burning mountain" was a common way to refer to volcanoes in the eighteenth century. Newton, explaining that volcanoes and other phenomena were caused by sulfur in combination with water and iron, used the term burning mountain to refer to volcanoes (Sigurdsson 104). Wakefield, like Piozzi, is also utilizing the chemical theory to understand volcanoes. The description suggests that Vesuvius is a static and uncommon feature of the globe instead of part of a complex system. Wakefield also describes the lava flows as liquid fire, instead of liquid rock, another idea from the chemical theory. She does though note that Vesuvius erupts in a cyclical fashion and that its eruptions are deadly to human societies. So while Wakefield might not describe Vesuvius as part of an igneous system, she tells the reader that the volcano operates consistently over time and has a direct impact upon humanity.

The description of Vesuvius continues, stating that "Such a wonderful phenomenon attracts the notice of all strangers" (Wakefield 184). Obviously this is true;

all the previous writers, including Hamilton and Piozzi, and accordingly Wakefield makes note of the entrancing quality of the volcano, especially to tourists. The Seymour family quickly decides to hike the volcano and peer into the burning mountain. They observe empirically in a fashion that is very similar to Hamilton's excursions up and down Vesuvius (W. Hamilton 6-7) trying to understand the mountain by exploring it personally. As noted by Rudwick "Until quite late in the eighteenth century, all three branches of natural history were still mainly indoor sciences. Travel and fieldwork were indeed considered essential, but they were undertaken primarily to collect specimens, which were then gathered indoors" ("Minerals, Strata and Fossils" 270-71). Geologists gathered samples from the field, but the field itself was not worth studying. At the turn of the nineteenth century, fieldwork became more important so that the scientist could begin to see with their "own eyes how the various minerals and rock masses were spatially related to one another" ("Minerals, Strata and Fossils" 271) instead of merely examining the minerals and rocks outside of their contexts. Hamilton's work helped show the value of empirical research to the Royal Society, whereas Wakefield is showing the importance of field work to children. She prepares them to see evidence gathered in the field as equal in value as theorizing.

First, as the family walks up the mountain, "they passed over fields of lava, which is the substance that remains, when the liquid torrents of fire from the mountain become cold and harden" (Wakefield 185). The description here repeats the idea of liquid fire and the idea of a chemical reaction as the lava is what "remains" after the liquid fire has cooled, much like the remaining ash after a wood fire. After noting the changes that lava

undergoes over time, the Seymours walk across a recent lava flow, “They observed the remains of an eruption, which had happened but a few weeks before, still smoking, and, though perfectly solid, was so hot as to be uncomfortable to their feet” (Wakefield 185). The Seymour family’s experience parallels Hamilton’s again (W. Hamilton 36). Even though Wakefield does not cite Hamilton as an influence, he did help establish the Vesuvian hike as part of the Grand Tour by taking the elite up the volcano (*Vesuvius* 233). The hike was popular because of the fireworks: “vivid flashes of fire were seen issuing from the top, accompanied with a loud, rumbling sound within the mountain; to these succeeded showers of red hot stones” (Wakefield 185). Wakefield’s description highlights the active nature of the volcano, even if it is only to heighten the excitement of the Seymour family’s ascent. As they hike further on, a sudden cascade of lava comes out of the mountain: “the most astonishing spectacle was a cataract of fire, the stream of red-hot, liquid lava, flowing over a high rock into a valley, on one side of Salvatore, and continuing to flow a considerable space after it had reached the ground, in the form of a river of fire, rendered still more brilliant by the darkness of the night” (Wakefield 185). The language used to describe the lava is tangled. Certainly, the substance is given liquid properties, with the use of cataract, stream, liquid, and river. But the difference between fire and lava is quite large. And the word lava had only recently been adopted, during the eighteenth century, into English language from Italian (“Lava, n”) so there might have been some ambiguity to its usages still. This description, though it does connect to the idea of molten rock still seems to indicate the lava was liquid fire. The layering of

spectacle, the lava flow and the shower of stones, help prepare the reader for the summit of Vesuvius.

After a trying hike, the Seymours finally get to see the mouth of the dread volcano: “A column of black smoke rose from the crater, which concealed the sides; vivid bursts of flame, at short intervals, mingled with the curling smoke, and cast a momentary glare of light upon the obscurity it occasioned. The solemnity of the rumbling thunder that accompanied the flashes of fire” (Wakefield 186). The description focuses on the illumination of the smoke and the sounds the family hears. Wakefield’s use of sensation highlights the power of Vesuvius, even though it is not in full eruption. And the description has some similarities to Hamilton’s in his first letter: fire, black smoke, and violent reports (W. Hamilton 4). The Seymour family is riveted by the view of the rumbling volcano. Wakefield says that “they contemplated the scene before them with a mixture of awe and astonishment” (Wakefield 186). Like Piozzi, Wakefield connects the reader with the emotional experience of her characters. Vesuvius is overwhelming and shocking. Wakefield does not lose her reader trying to transport them. She was not interested in the more Romantic mode of writing as noted earlier (Shteir). Given Wakefield’s lack of interest in emotionally-focused writing, her description of Vesuvius as awesome and astonishing shows how impressive the volcano was. Wakefield had never even seen Vesuvius, but she thought describing the emotional register of her characters was important to convey the volcano’s magnitude. The narrator goes on to say that “it was some time before any of the company broke silence, so much were they affected by the sublimity of the objects around them” (Wakefield 186). The Seymours are

dumbstruck by the volcano, surprised and in awe of the sublime geologic features. The emphasis on the Seymours' feelings shows how massive volcanoes are both in the world and in the mind. Wakefield affords Vesuvius respect through this description, demonstrating human beings' insignificance in the face of volcanic action. While *The Juvenile Travellers* might not spend as much time with the relationship between volcanoes and the environment, the impact volcanoes have on the human world is displayed in both benevolent and grim terms.

After the silent moment at Vesuvius's mouth, Mr. Seymour tells his family more about the volcanoes. He draws a parallel between Vesuvius and the Alps, noting that both are uninhabitable by people. But, as Mr. Seymour continues, that does not mean that either Alps or Vesuvius are pointless: "but do not let us suppose that they are, on these accounts, useless, or blemishes in the beautiful work of creation" (Wakefield 187). The importance of such mountains, whether of ice or fire is that they are shelters against destructive wind, they are filled with valuable minerals, they are the habitat for other animals, and they might even be the strong ribs that "bind and strengthen the globe itself" (Wakefield 187). Mr. Seymour presents a very compelling and ecologically oriented argument for mountains in general and volcanoes in particular. His rationale for the value of volcanoes is that they connect to both human and animal activity. Most of what Mr. Seymour considers important features only further human ends, like sheltering cities or containing minerals. Offering habitats for other animals does not directly impact human lives. In a few brief sentences, Mr. Seymour provides important ecological links between volcanoes and human societies. Like Hamilton's view that volcanoes provide fertile soils,

Mr. Seymour argues for the many benefits that volcanoes provide. Mrs. Seymour follows up on her husband's line of thinking, declaring that volcanoes are useful because they give "vent to the fires within the earth, which might otherwise, struggling for room, convulse and overturn the whole frame of nature" (Wakefield 188). Mrs. Seymour's statement is explicitly Plutonist because of the reference to a central fire. She also shows volcanoes in a systematic fashion, saying that without volcanoes the earth itself might not be habitable. While Wakefield does not spend time dwelling on the specific theories or ideas, she does strongly place volcanoes in a system with human beings and the earth.

The Seymours' trip to Vesuvius ends with a visit to Herculaneum and Pompeii. As with the family's experiences viewing the volcano, Wakefield does not hold back on the sheer, destructive power of the volcano. The family sees antiquities from Herculaneum and inspects the houses in Pompeii (Wakefield 189-90). Mr. Seymour says upon viewing the ruins that "The sufferings of the people whose lot we lament, were but short, though whilst they continued, extremely dreadful, involving all ranks equally in the same ruin; the prince and the subject, the master and the servant, the great and the humble, all were overwhelmed by the same irresistible torrent of lava and hot cinders" (Wakefield 191). Mr. and Mrs. Seymour then notice that their children are crying and decide to conclude their visit to Pompeii. As with the view of Vesuvius' crater, Wakefield makes strong statements with few words. Juxtaposing Mr. Seymour's statement about incredible suffering of the Romans with Theodore and Laura crying shows how unsettling the ruined city is. Pompeii is a reminder of the power volcanoes exert over human civilization. Neither class nor station was a guarantee against a

pyroclastic flow. As Laura and Theodore think about the process of being encased in lava and hot cinders, they cry, unsettled like Piozzi was upon viewing the ruins. Wakefield does not attempt to reduce the potential impact of volcanic eruptions for her young audience. She lets them see both the great benefits, making the world habitable, and the great horrors, an agonizing death.

When the Seymours' explorations are complete, they leave Naples by ship. While they are sailing away, Laura looks back at the city and sees "in the back ground, Vesuvius issuing out volumes of fire and smoke. After contemplating this highly-varied and beautiful scene for some time, Laura chanced to turn round" (Wakefield 219). Laura, upon turning, inspired by the picturesque Neapolitan scene, sees a variety of forms in the clouds like castles, parks, and people. Vesuvius inspires her, causing her suddenly to say that she believes in fairies. Laura's flight earns a swift response from Mr. Seymour. He tells his daughter that fairies "have no existence except in the brains of poets and romance writers" and that what they are seeing, despite its "charming appearance is a natural phenomenon" (Wakefield 213). Mr. Seymour emphasizes rationality, not romanticism to his daughter. The world is composed of phenomena that are understandable by human minds. Despite the great transport that Vesuvius can cause, Wakefield does not let her young characters escape into fancy. She advocates for scientific rationality and empiricism, even for young women. Although the natural world is beautiful and astonishing, it can and should be understood empirically by males and females alike.

After Naples, the Seymour family visits Mount Etna on Sicily, which happens to erupt while they are there. Mr. Seymour, infatuated with natural philosophy especially expanding his fossil collection and learning more about Sicilian agriculture, has his family stay on the island "notwithstanding the extraordinary bellowing of the mighty volcano, and repeated shocks of slight earthquakes had given notice of an approaching eruption" (Wakefield 256). Not long afterwards, while Mr. and Mrs. Seymour are on a pre-breakfast walk "the ground shook so terribly, that they were both thrown down" (Wakefield 256). Calamity ensues, Theodore is swept away by a tsunami, and many others die by being dashed against rocks (Wakefield 256-57). As the volcano and its cinder cones erupt, "consternation seized the most courageous: the people fled on all sides, they knew not whither; numbers perished, and multitudes lost all their possessions, and were reduced to the most abject poverty" (Wakefield 260). Unlike the visits to Pompeii and Herculaneum, Wakefield portrays the horrors of volcanic action in progress. The result is dire for both the inhabitants of Catania and the Seymour family. No longer can the characters merely reflect on the remains of volcanic victims. They become victims. Theodore is apparently dead. Wakefield shows her audience that volcanoes are greater than people and that there are no protections against them. Mr. and Mrs. Seymour are understandably interested in leaving Sicily as quickly as possible, given both the desolation of the country and the pain of recalling their lost son. Theodore is not in fact dead, merely washed out to sea, where he is picked up by Turkish pirates. Eventually the Seymour family is reunited in Britain, after traveling over most of Europe and living

through a volcanic eruption. The Seymours' experiences though show that volcanoes are intrinsically linked to human societies, but that connection is a dangerous one.

Wakefield's conception of volcanoes differs from Hamilton's. Her understanding of geology, despite publishing about twenty-nine years after Hamilton, is still inflected by chemical theories of volcanoes yet also includes references to the ideas of internal heat. Wakefield does not frequently emphasize the time or the scope of volcanic action, but recognizes its cyclical nature. She places volcanoes inside of a human-oriented system, but one that links to the rest of the natural world. Wakefield emphasizes the ability to understand volcanoes and the world through rationality but also notes that human beings are still quite powerless in the face of volcanic action. Referring back to the preface, one of the aspects of other countries that Wakefield wants young readers to understand is that country's climate: "have a general idea of the face of nature in different climates" (Wakefield iii). The word climate has a variety of different meanings, and is changing at the turn of the nineteenth century, but certain senses of the word do reflect the idea of an ecological system, especially "The characteristic weather conditions of a country or region […] esp. as these affect human, animal, or plant life" ("Climate, n.1."). Wakefield is positing that by understanding the environment one might understand its inhabitants, which is itself a way of thinking about systems. While Wakefield's conception of geological action is different at points than Hamilton's, she repeatedly places volcanoes inside of human-ecological systems that show both their benefits and the dangers.

Hamilton's, Piozzi's, and Wakefield's texts, three of the most popular books of the era, given their frequent reprintings, for their respective audiences, show the complex

network of volcanological thinking. Hamilton's text addressed the Royal Society and science-minded individuals, but that does not mean that Piozzi's and Wakefield's books were unnoticed; they were very popular writers in the late-eighteen and early-nineteenth centuries. And as Barnard argues volcanic accounts by women, fictional or not, "opened up scientific reflection and encouraged their readers towards further exploration" (T. Barnard 51). All of the writers highlight the powerlessness of humanity in the face of volcanic events, which is not unexpected. Especially after viewing either Pompeii or Herculaneum, the authors easily recognize how fragile human life and its technologies are compared to volcanic events. Hamilton and Wakefield both note that volcanoes also benefit human progress, although in different ways. Hamilton and Piozzi start to demonstrate understanding volcanoes through geologic time: both recognize the immensity and scale that volcanoes operate upon. Piozzi even manages to express that scale better than Hamilton, by placing the time scale in aesthetic terms rather than Hamilton's drier observations. Hamilton is the only one of the three who views volcanoes as part of a geological system. Wakefield emphasizes the study of the natural world, echoing Hamilton's advocacy for field work. Piozzi provides the most aesthetic view of volcanoes, highlighting the fear and awe associated with them, the emotions that such massive phenomena evoke. These three texts are part of a larger conversation; as Wood notes about Hamilton's letters: "Readers did not passively receive the testimony of recorded events, as is often implied […]. Rather they spent time participating in the process of attending to nature. Just as Hamilton had noted and studied a strangely formed rock, so his distant readers were able to note and study it also" (K. Wood 95).

Hamilton's, Piozzi's, and Wakefield's contributions to that conversation are all distinct: different genres, audiences, and purposes. But they show important similarities, like a tendency towards systemic thinking and a recognition of the ultimate power of volcanoes. Recognizing the violence of volcanoes is not particular to the late eighteenth century. The connections made between that violence, human life, and the surrounding environment, especially over time, in the late eighteenth century make the recognition much more important because by seeing these ecological links eighteenth century thinkers were helping to enmesh human life with environmental causality, suggesting that human civilization is affected by its world. These ideas set volcanoes up to be more and more integrated into complex, geological systems thinking in the nineteenth century, which would begin to privilege the volcanological over the anthropological.

THE LAST DAYS OF THE SYMBOLIC VOLCANO

In the early part of the nineteenth century Europe was devastated by two volcanic eruptions: the 1783 eruption of Lakigígar in Iceland and the 1815 eruption of Tambora in Indonesia. These two volcanoes alone killed close to 70,000 people (Oppenheimer 50). Despite a drastic impact, including regionalized climate change, these volcanoes went largely unnoticed by the British. Instead, what mattered more to British culture was symbolic volcanoes. The idea of the volcano took up more discursive space, thanks no doubt to Sir William Hamilton's work, but also thanks to symbolic volcanoes. Symbolic volcanoes had human meaning: revolution, wrath, and unrest. Europe seemingly was in the middle of a figurative volcano with revolutions in France, Portugal, Greece, the Netherlands, Ireland, and unrest in Britain among many others. There were revolutions in the colonies, including the United States, Haiti, Chile, and Argentina. Each revolution was a caldera that exploded, raining down rebellious sentiment in neighboring areas. While using volcanoes as a metaphor was handy for writers of the era, it was not a new development in volcanological work or systems thinking.

A few writers though stripped volcanoes of symbolic, human-focused meaning, suggesting that volcanoes were objects that had their own existence and trajectories, ultimately having more of an impact than actual volcanoes. Laki's and Tambora's were not widely recognized; they affected British culture through dramatic weather, but they were not seen as the sources of the weather. Volcanoes in British scientific works, novels, poems, and dramas were the most salient at the time. The writers who depicted volcanoes as merely natural features helped move volcanoes towards being included in an igneous

and environmental network, by decoupling them from human-focused meaning. Despite strong volcanic eruptions in the early part of the nineteenth century, the most impactful volcanoes for culture were textual ones. The most important work done with textual volcanoes was attempting to remove any metaphoric meanings or symbolism from them. Sir Edward Bulwer-Lytton, in *The Last Days of Pompeii* (1834), and Charles Lyell, in *The Principles of Geology* (1830-33), both described volcanoes in their works in ways that downplayed symbolic meaning, helping to further both volcanology and systematic thinking about volcanoes and their network of environmental relations.

In 1783 a volcanic fissure in Iceland called Lakigígar, frequently shortened to Laki, erupted. The eruption was not spectacular like Vesuvius's eruption in 79: no cities were buried under ash or pyroclastic flows. Nevertheless Laki's eruption had a major impact on both Iceland and Europe. Laki emitted the largest amount of lava "in the past millennium" (Oppenheimer 269), although fortunately the lava itself did not kill many people. The danger of Laki was the chemical composition of the lava. The volcanic degassing of Laki "discharged more than half a gigatonne of carbon dioxide, water vapour, sulphur dioxide, hydrogen fluoride and hydrogen chloride" (Oppenheimer 44) into the atmosphere. Laki's poison gas cloud had a devastating effect. The eruption killed about twenty-five percent of Iceland's population through fluorine poisoning (Oppenheimer 269). The gas cloud also drifted south across Europe and even to parts of Africa and the Middle East. The Laki eruption "precipitated an environmental crisis in Europe. Tens of thousands of people perished in England and France" (Oppenheimer 269). An estimated 10,521 people died from famine or epidemic disease (Oppenheimer

50). The strange weather further alarmed many Europeans (Brayshay and Grattan 183) and may have even helped start the French Revolution (Oppenheimer 293). Despite the broad impact, few people made the connection between Laki and the strange weather in the summer of 1783, although many contemporary writers recorded the effects of the Laki Haze as it moved across Europe.

Brayshay and Grattan use this primary source evidence to construct a picture of environmental and social responses to the haze; their data show that Laki's cloud probably impacted a region that stretched from Lisbon to Vienna, and from Aberdeen to Tunis (Brayshay and Grattan 185). The eruption started in June with the volcanic gases drifting over Europe throughout the summer. Gilbert White, in *The Natural History and Antiquities of Selborne* (1789), makes note of the effects of the Laki Haze "The summer of the year 1783 was an amazing and a portentous one, and full of horrible phænomena; for, besides the alarming meteors and tremendous thunder-storms [there was also] the peculiar *haze*, or smoky fog, that prevailed for many weeks in this island" (White 301). The haze masked the sun and gave it a red color scaring people and causing an unseasonably hot summer (White 302). He also noted the occurrence of earthquakes in Calabria and Sicily, and the appearance of a new volcano off the coast of Norway. At the time, Norway was part of a political union with Denmark, and Iceland was one of Norway's possessions. White could be referring to Laki or he could be referring to the Reykjanes volcano which also erupted in 1783, although the volcano being off the coast Norway suggests otherwise. Regardless, he does not give the volcano more than twelve words. He does not consider why the haze is occurring. Instead, White concludes by

quoting *Paradise Lost* 1.594-99, where Satan is compared to an eclipse that "*sheds* / On half the nations, and with *fear of change* / *Perplexes* monarchs" (White 302) suggesting that political changes may result from the strange weather. White is just one observer, but he has a sharp ecologically-oriented eye, and yet Laki itself remained outside his field of vision.

At least one person connected the haze across Europe with a volcano: Benjamin Franklin. During the Laki eruption, Franklin was the American ambassador to France. Reportedly, the haze cloud reached Paris around mid-July (Brayshay and Grattan 179). Franklin observed this cloud and noted the change in an unpublished essay titled "Meteorological Imaginations and Conjectures" (1784). There he says that "During several of the Summer Months of the Year 1783, when the Effect of the Suns Rays to heat the Earth in these northern Regions should have been greatest, there existed a constant Fog over all Europe" (B. Franklin). Using this data, Franklin argues that the fog reduced the effectiveness of the sun's radiation, so that the earth was cooler come winter in the northern hemisphere. Franklin was right, the winter that year was cooler, so cold the Thames froze (Oppenheimer 280). In the paper Franklin speculates about the origins of the clouds, theorizing that the fog might have instead been smoke: "Or whether it was the vast Quantity of Smoke, long continuing to issue during the Summer from Hecla in Iceland, and that other Volcano which arose out of the Sea near that Island; which Smoke might be spread by various Winds over the northern Part of the World; is yet uncertain" (B. Franklin). Franklin's hypothesis is fascinating and he is proven correct. Yet it was only in the second half of the twenty century that geologists made strong claims for the

connections between volcanoes and climate (Robock 191) despite the awesome effect volcanoes can have on climate.

One of the deadliest volcanic eruptions in modern history, Mount Tambora in 1815, went largely unnoticed in nineteenth-century Britain. Tambora's eruption was a volcanic explosivity index [VEI] 6.9 – 7 (Oppenheimer xiv) which makes it one hundred times larger than the Mount St. Helens eruption in 1980 (a VEI 5) or ten times larger Pinatubo in 1991 (a VEI 6). Tambora's eruption may have been the largest eruption on the earth since 1258 CE when an unknown volcano (perhaps Mount Rinjani in Indonesia) erupted and contributed or caused the Little Ice Age of the Middle Ages (Oppenheimer xiv). Tambora's eruption had a significant impact on the climate. The eruption itself was massive. Eyewitness accounts put Tambora's ash plume at about twenty-six miles high (Oppenheimer 299) with the volcano releasing twenty-seven megatons of sulfur into the atmosphere (Oppenheimer 357). While Tambora only released a twenty-two percent of the sulfur that Laki released, it dispersed the gas at a greater height: twenty-six miles versus eight miles (Oppenheimer 276). The initial eruption killed more than 11,000 people with super-heated rock and ash clouds, as well as boulders and volcanic bombs (Oppenheimer 50). The eruption also injected sulfur and ash into the atmosphere, which killed many more by cooling the planet and destroying harvests: "The years 1816-1817 witnessed the worst famine in Europe and North America in over a century" (Oppenheimer 312). And yet relatively few people throughout the world even knew about Tambora.

Many people were affected by Tambora's eruption: as Oppenheimer claimed above, Tambora caused widespread famine and disease in parts of the Northern Hemisphere. As Gillen D'Arcy Wood notes “historical actors themselves were ignorant” of the volcano's influence in Europe (G. Wood 5). He says, “no one linked that single, barely reported geological event with the cascading worldwide weather disasters in its three-year wake” (G. Wood 2). The British were aware of Tambora’s existence: there were a few news reports, such as an article in *The Bury and Norwich Post* which reported that “A volcano broke out at the mountain of Tomboro” (“Tuesday’s Post”). Similarly, a reprint/paraphrase of the same article appears in *Trewman's Exeter Flying Post* only a few days later. There was some knowledge, among those who read newspapers, that “Tomboro” on the island of Sumbawa had erupted (“Queen’s Drawing-Room”). The article describes the eruption as “by far the most violent that ever happened in the history of the world, far exceeding in the extent of its effects, any of Vesuvius, Ætna, or Hecla” (“Tuesday’s Post”). The effects of Tambora did exceed the other volcanoes listed, although not in the fashion that the writer had in mind. Tambora’s eruption drastically cooled the northern hemisphere; the summer was -0.51 degrees Celsius cooler in 1816. As the conversation around global climate change has indicated, even a small change in temperature can have dramatic effects. The results of Tambora’s eruption were no different. These low temperatures destroyed crops in the United States, Britain, and Germany (Oppenheimer 312-313). Researchers estimate that more than 49,000 people died from famine and disease due to the eruption, which makes Tambora the deadliest

volcano in modern human history (Oppenheimer 50). Still, Tambora was largely unknown, and especially its impact on day-to-day life.

Despite the relative anonymity of both Laki and Tambora, they were still quite important in shaping the early part of the nineteenth century. Multiple books have noted the parallels between the eruptions of these volcanoes and subsequent cultural developments. William and Nicolas Klingaman in *The Year Without Summer* (2013) and Gillen D'Arcy Wood in *Tambora* (2014) argue for Tambora's impact on both human life and culture, especially on the literature of the Romantic period. Alexandra Witze and Jeff Kanipe make a similar claim for the importance of the Laki eruption and the development of European culture in *An Island on Fire* (2014). Clive Oppenheimer devotes a chapter each to the volcanoes and also details their cultural impact. These works, among others, outline how actual volcanoes changed European, especially British, society. While Laki and Tambora changed people's minds, they did not change people's minds *about volcanoes*. As noted earlier, few writers made that connection, or even could. Therefore the volcanoes that dominated culture at that time were textual volcanoes, written about by influential authors and natural philosophers.

As detailed in chapter 1, the most salient volcanoes for British readers were in Europe. The researches of Sir William Hamilton, among other travelers and natural philosophers, introduced readers to Etna and Vesuvius. Hamilton through dangerous intimacy with the operations of nature gave readers spectacular scenes "I approached the mouth of the Volcano, as near as I could with prudence; the lava had the appearance of a river of red hot and liquid metal, such as we see in the glass-houses, on which were large

floating cinders, half lighted, and rolling one over another with great precipitation down the side of the mountain" (W. Hamilton 6-7). Hamilton's passage is riveting both because of the mesmerizing nature of lava and because of the sheer danger he was in. Hamilton along with Alexander von Humboldt, Humphry Davy, George Mackenzie, and Madame de Staël helped make volcanoes "all the rage in the early nineteenth century" (G. Wood 33) in addition to others, like Hester Piozzi and Priscilla Wakefield. In part this was because volcanoes were an easy symbol.

Volcanoes were frequently a metaphor in the nineteenth century for revolution (J. Hamilton 98). The French Revolution (1789–99) was often described using volcanoes. According to McCallam, the volcano and the revolution were seen as similar due to the aesthetics of the natural sublime and its similarities to the political sublime (McCallam 55). The volcano was an easy substitution for revolutionary sentiment. McCallam specifically identifies three forms that the volcano took in the revolutionary discourse: "a figure of the abstract power of the Revolution [or …] an image of the indomitable revolutionary orator [or …a symbol of] the collective might of the people" (McCallam 58). The volcano represented the long pent-up and explosive sentiments of the revolutionaries. In *Le Jugement dernier des rois* (1793) a radical play by Sylvain Maréchal, "the volcano, symbol of revolutionary fervor and destruction, became the ultimate demonstration of nature's justice, annihilating the monarchs in a single, terrifying, and glorious moment" (M. Miller 556). Mary A. Miller argues that the volcano was a positive image during the revolution, because of its danger and its ability to represent "constructive and purgative" change (M. Miller 559). Sanja Perovic concurs

with Miller, noting that the volcanic imagery allowed the revolutionaries "to align a revolutionary history predicated on rupture with a natural (and anti-Christian) time derived from geology and the earth sciences, the volcano articulates the same temporality as the new calendar" (Perovic 25). Yet counter-revolutionaries also used volcanic imagery to represent the "instability and self-destructiveness" of the revolution (M. Miller 567). Even after the Revolution, the volcano would hold on to its radical associations. Kathleen Hart argues that even into the 1830s and 1840s, the volcano was still being used in French literature as a revolutionary symbol. Hart connects the volcanoes in Flora Tristan's *Pérégrinations d'une paria* (1838) with the dangers of oppressing women (Hart 55). While important, these usages of volcanoes have little to do with actual volcanoes, minus the fodder for analogy they provide.

Nicholas Daly claims that "fires of revolution that seem to burn most brightly in the heart of the volcano" and despite each individual revolution's rationale at the turn of the nineteenth century "volcanic entertainments owe at least some of their success to their very capacity to absorb such changing political content" (Daly 256). Using volcanoes as a metaphor for social upheaval makes sense: "The destructive spasms of the erupting volcano seemed the most apt image for the unprecedented bloodletting and upheaval that swept civilian Europe" (G. Wood 36). But actual volcanoes still existed and their actions could not be seen as a social revolution, merely a natural disaster but one detached from human significance. As the science of geology provided further explanations for volcanic activity, the ability for the volcano to remain merely a symbol or a metaphor waned. Certainly, the volcano could be used in a simile, because revolutions were like volcanoes:

calm and then suddenly violent. But the volcano also was a feature of the terrain that was unable to care for revolution or gods. As natural philosophers began positing new mechanics for volcanoes, writers began to divest volcanoes of meaning. Volcanoes loomed large with human civilization in their shadow, but not as divine agents, just massive objects that could on a whim destroy thousands of lives.

1. Faith

One of the writers who divested volcanoes of meaning was Sir Edward Bulwer-Lytton and his novel *The Last Days of Pompeii* (1834). Edward Bulwer-Lytton's novel follows a group of Greeks and Romans living in Pompeii right before the eruption of Vesuvius in 79 CE. The protagonist Glaucus, a Greek, attempts to win the heart of Ione, another Greek. The cast includes Nydia, a blind slave, and Arbaces, an evil Egyptian and the antagonist. In the end Glaucus and Ione escape Pompeii as Vesuvius erupts behind them. Bulwer-Lytton managed to tap into a Pompeii revival that was sweeping Europe at the time. Vesuvius and Pompeii were popular at the beginning of the nineteenth century; Wood points out "The excavation of Pompeii, a half century before, had brought volcanism alive to the imaginations of Europeans. The unearthed city presented a stunning image of human calamity in the face of a major eruption" (G. Wood 33). And in the nineteenth century Vesuvius and Pompeii became short-hand for a natural disaster which devastates a human population (G. Wood 34). Much of the inspiration for the story was taken from Bulwer-Lytton's own visit to Pompeii. Bulwer-Lytton ended up writing

most of the novel while in Naples (Harris 167). His fascination was no doubt helped by William Gell, who was "the single most influential of the early post-Napoleonic visitors" to Pompeii (Harris 160). Gell published *Pompeiana. The Topography of Edifices and Ornaments of Pompeii* in 1817-18 and helped "introduced Pompeii to the English speaking world" (Harris 160). Bulwer-Lytton ended up dedicating his novel to Gell.

Bulwer-Lytton's novel sold so well that the *Last Days of Pompeii* has been compared to Sir Walter Scott's *Waverley* (1814) in terms of success; it helped make the publisher Richard Bentley wealthy (Simmons 103). Scholars have speculated about why the novel was so popular. James C. Simmons believes that timing was key to *The Last Days of Pompeii*'s success. Vesuvius "after a decade of disturbances […] erupted on August 27, 1834" (Simmons 103), the month before the publication of Bulwer-Lytton's novel on September 29, 1834 (Simmons 104). Contemporary reviews did not comment on the timing of the novel's release, but instead focused on the combination of artistic skill and historical facts. The *Southern Literary Messenger* said that "The work before us is one of undoubted merit. The subject is of great historical interest, and the author has contrived to reanimate the 'city of the dead' with a group of actors who, with some exceptions, admirably sustain their respective parts, and contribute their due share to the continued interest and final catastrophe of the story" ("*Last Days of Pompeii* Reviewed" 241). The book's success was likely more than just lucky timing: before the copyright ran out, the book went through seven editions (St Clair and Bautz 57). After the copyright expired, Routledge alone published four more editions in the nineteenth century (St Clair and Bautz 57) and none of these numbers account for the United States where the book

was printed regardless of copyright. *Last Days of Pompeii*'s success was more than just a barometer of Vesuvian eruptions.

Bulwer-Lytton's modern reputation is a bit less sterling. He is unfairly seen as the inventor of purple prose, especially because of the opening line "it was a dark and stormy night" from *Paul Clifford* (1830). *The Last Days of Pompeii* is not frequently reprinted in the twenty-first century. Still, *The Last Days of Pompeii* has attracted academic attention and interpretations. Daly sees the novel as focused on revolution, again, noting that "In this respect it is hard not to see it as a novel inspired by the Reform Act of 1832, with its picture of a pleasure-seeking aristocratic class poised on the verge of extinction at the hands of seismic forces beyond their control" (Daly 274). As noted earlier, Daly also claimed that volcanoes were able to easily absorb the political content of the day, he goes on to say that "the eruption could function either as a providential holocaust that devoured the wicked and spared the Christian and proto-Christian, or as a fiery cataclysm that tragically overtook all" (Daly 269). A religious holocaust is the way that St Clair and Bautz see the novel; they claim that "The destruction of Pompeii, according to the *Last Days*, was the result of divine providence. Pompeii was added to the list of cities, including Sodom, Gomorrah, Babylon, Tyre, and Nineveh that the Judeo-Christian god had righteously punished" (St Clair and Bautz 55). Both of these interpretations are supported by some of the evidence in the novel. That being said, the eruption of Vesuvius and its destruction of the city can also be read as neither a social nor a religious revolution. Even though there is a parallel between the decadent Romans and the pious Christians, the novel provides neither a complete religious cataclysm nor a complete

obliteration of decadent Rome. Instead, the novel presents the eruption of Vesuvius as a complex phenomenon that interrupts the lives of a diverse cast of characters.

Religion and faith are connected to the eruption of Vesuvius in the novel because they are the primary tools the characters of the novel use to either foretell or understand the eruption. Religion is even more prominent in the novel because of the variety of faiths in the story: the standard Greco-Roman pantheon, some Egyptian theology, and even nascent Christianity. The eruption of the volcano and the beliefs of the characters cannot be disentangled. Tracking what the characters believe provides value evidence for how the eruption should be read. Only the pagan Egyptian faith successfully learns of the eruption. The Christians and the followers of the Greco-Roman faith gain no insight. Bulwer-Lytton's audience was largely Christian, and their faith's inability to successfully foretell or respond to the eruption suggests that faith is not the best lens to view volcanoes through.

Most of the characters in the book worship the Greco-Roman gods. They regularly reference a variety of deities, like Jupiter or Venus (E. Bulwer-Lytton 11). They keep "images of the household gods" in their dwellings (E. Bulwer-Lytton 20). The Greco-Roman faith does include a prominent volcano god, Hephaestus / Vulcan who lives under Mount Etna. Coincidently Pompeii in the novel was preparing to celebrate a Vulcanalia (E. Bulwer-Lytton 27) although Vesuvius beats them to the punch. Despite the Greco-Roman religion's broad acceptance, it seems like the most impotent religion of the three in the novel. The adherents' prayers go unanswered and they receive no divine revelation of the impending eruption. The lack of divine assistance for Roman's

maintains one of the novel's themes: the worship of Zeus, Venus, Vulcan, etc. was not really a faith, just the trappings of a religious practice.

While the Christians in the novel are frequently referred to as "atheists" (E. Bulwer-Lytton 32), the adherents of the Greco-Roman religion are the most atheistic. Late in the novel they parade through the city singing an "Epicurean Song" which ends with the couplet "We care not for gods up above us– / We know there's no god for this earth, boys!" (E. Bulwer-Lytton 435). The song suggests a disconnect between the people and their gods, further emphasizing the decadent nature of the Roman society. In the novel the Greco-Roman culture is defined by slavery and gladiatorial combat. The religion is attached to those and other cultural ills. The Christian Olinthus argues to Apæcides, Ione's brother, that the Greco-Roman faith is inherently immoral and corrupt: "You are told to worship your gods. What are those gods, even according to yourselves? What their actions, what their attributes? Are they not all represented to you as the blackest of criminals? yet you are asked to serve them as the holiest of divinities. Jupiter himself is a parricide and an adulterer" (E. Bulwer-Lytton 87). Olinthus claims that the Greco-Roman religion reflects the culture in dark ways, with the head god being a murderer and rapist. He uses this logic to help convince Apæcides to convert to Christianity. In the novel, the Greco-Roman religion is powerless in the face of violent geologic upheaval: their worshippers are burned away, surprised and unable to contextualize Vesuvius' eruption. While the situation in the face of the volcano of the Greco-Roman religion matches the theme of decadence well, the theme breaks down with the Egyptian religion.

The religion of antagonists, Arbaces and his worship of Isis and the hag and her Etrurian (Etruscan) beliefs, actually seem to have the most foresight of the oncoming volcanic doom despite being corrupt. The Egyptian faith does not have a volcano god, but that does not stop it from receiving warnings about the volcano. Early on in the novel, in the Temple of Isis, a crowd of worshipers hears the prophecy of Isis which states:

> There are waves like chargers that meet and glow,
> There are graves ready wrought in the rocks below,
> On the brow of the future the dangers lour,
> But blest are your barks in the fearful hour. (E. Bulwer-Lytton 43)

The worshippers interpret the prophecy to mean that there will be a storm because both waves and barks (boats) are mentioned. Of course, these waves happen to glow and they are associated with earthly graves, not watery ones. Being on a ship at sea during a storm would also not be very fortunate. But if one were on a boat during the eruption of landlocked volcano, one would be much better off. The prophecy is one of the most accurate in the novel, foreshadowing the eruption of the mountain. Despite this, Arbaces himself claims that the cult of Isis is corrupt and dishonest: in a conversation with his apostate priest, Apæcides, Arbaces claims that Apæcides's loathes the Egyptian priests' manipulations of the faith "you are revolted at their trickeries and imposture" (E. Bulwer-Lytton 61). Arbaces does seem to be deceiving his followers, using a religion for his own gain. But his religious visions are closer to reality than any other faiths'. Later in the novel, Arbaces has another vision where he meets Nature, who is described as a "giantess seated upon a pile of skulls" (E. Bulwer-Lytton 443). She tells Arbaces that her purpose is to report the "forecast of thy soul—the prescience of thy rushing doom—the shadow of thy fate lengthening into eternity as declines from earth" (E. Bulwer-Lytton 445). Nature

tells Arbaces that he is doomed. As a priest of Isis, Arbaces has the most foreknowledge the eruptions, yet does nothing.

Similarly, the hag arrives in the city hours before the explosion to tell Arbaces to flee: “Listen to me. Some evil hangs over this fated city. Fly while it be time” (E. Bulwer-Lytton 446). She goes on to tell him that she has good evidence that the mountain will explode, because she lives in it and because “I remembered the dark Etruscan prophecy which saith, ‘When the mountain opens, the city shall fall—when the smoke crowns the Hill of the Parched Fields, there shall be woe and weeping in the hearths of the Children of the Sea’” (E. Bulwer-Lytton 447). The Etruscan faith had a god, Sethlans, who was linked with Hephaestus / Vulcan and potentially volcanoes. If the hag’s prophecy comes from Sethlans, or any part of the Etruscan faith, it would further suggest that the Greco-Roman religion was seriously flawed if they received no assistance from Hephaestus / Vulcan. Arbaces agrees to heed the hag’s advice, saying he will leave in a few days. The hag herself says she will travel to Herculaneum to escape. Despite the fates of its worshippers, both the cult of Isis and the ancient Etruscan prophecies seem to have more insight unto the eruption of Vesuvius than the Greco-Roman pantheon. These faiths were gone by the nineteenth century, but the predictive power of the Egyptian and Etruscan faiths in regards to the volcano is odd given the lack of assistance the Christian faith receives.

The nascent Christian sect seems somewhere in between the other two faiths: they do not have a prophecy *per se* but are not short on explanations. Early on in the novel, Apæcides hears a prophecy from an old Christian while on his way to meet with

Olinthus, to discuss conversion. The old man, a former Jew of the Sadducee sect, tells his story of seeing Jesus and converting during Jesus's crucifixion and subsequent resurrection. The old Christian's narrative has a few interesting features that parallel the destruction of Pompeii: the sky goes dark and in that the earth shakes (E. Bulwer-Lytton 330). Karen Armstrong has noted that Yahweh might have been a god of volcanoes (Armstrong 21). Certain Bible verses, like Deuteronomy 4:11 and 5:23, support the idea that at one point Yahweh might have been a volcanic god. Volcanoes were also associated with the Christian afterlife, hell. Jeremy Harte follows a popular tale, published in multiple periodicals between 1779-1837, that claims that a man's ghost was chased into Stromboli upon his death. Harte notes that the story is either "a curious and instructive record" from 1686 or a "dramatic legal proof that a man had really been seen in the hour of his death being pursued into Hell" (Harte 329). The strange story suggests that nineteenth-century readers might have viewed volcanoes as apertures to hell, the entrance to divine punishment, which makes the Christians in the novel seem all the more ignorant when they are unprepared for the eruption.

The Christians in the novel do not seem to have any direct knowledge of the eruption. As a reaction to the atheistic "Epicurean Song" from earlier, the Christians sing "The Warning Hymn of the Nazarenes" which includes passages that presage the volcanic eruption like "The proud stars shall fail– / the sun shall grow pale–" and "Hell's ocean shall bare / Its depths of despair," (E. Bulwer-Lytton 436-37). These images reference the Apocalypse, or the destruction of Gomorrah. Olinthus even claims that Pompeii is Gomorrah (E. Bulwer-Lytton 484), but there seems to be no direct knowledge

of the eruption delivered to the Christian faithful. The Christians are sympathetic figures in the novel: their faith, while not banned, is scorned. They meet in secret (E. Bulwer-Lytton 204) and refuse to swear oaths by the Greco-Roman gods, which gets Olinthus thrown in jail (E. Bulwer-Lytton 350-51). Unsurprisingly, especially given the connection between the Christian god and ancient volcano gods of the Middle East, the Christians see the volcanic eruption not as their doom but as deliverance. Olinthus claims that the eruption is divine "This is the hand of God—God be praised!" (E. Bulwer-Lytton 483). His theory is that the volcano is destroying the city because of Pompeii's corruption, like a new Gomorrah (E. Bulwer-Lytton 484). The Christians even take the meaning of the destruction further, believing Vesuvius to be part of the Apocalypse. The narrator says that the Christians believed, in error, that the Last Day had come. A congregation of the Christians marched through the streets, while Vesuvius was still erupting, proclaiming God's judgment: "Behold! the Lord descendeth to judgment! He maketh fire come down from heaven in the sight of men!" (E. Bulwer-Lytton 495). These Christians still die though. Their belief that the Apocalypse is beginning is wrong. Instead of providing succor or fleeing, they fatally dance on the graves of their enemies.

One of the themes of the novel is the power of the Christian faith. Pompeii is described as a microcosm of the triumph and tragedy of Rome: "In its minute but glittering shops, its tiny palaces, its baths, its forum, its theatre, its circus—in the energy yet corruption, in the refinement yet the vice, of its people, you beheld a model of the whole empire" (E. Bulwer-Lytton 13). The corrupt energy causes many of the protagonists to change their ways. Multiple characters convert to Christianity by the end

of the novel, like Apæcides, Ione, and Glaucus. The Christians, as shown above, take the most value and meaning from Vesuvius, seeing it as divine wrath for Pomepii's corrupt energy. The plot further reinforces conversion: the pagan city, which is corrupt and sinful, is brought down and the virtuous of the heathens see the light of the Christian faith. Contemporary reviews note this virtue of the novel: "we think that Mr. Bulwer has endeavored at least, to do justice to the christian character and principles, […] especially in the early ages of the church, was content with ignominy, chains and poverty in this life, and courted even martyrdom itself, in the bright anticipation of eternal bliss" ("*Last Days of Pompeii* Reviewed" 246). The reviewer is right: the Christians of the novel are ignominious, impoverished, and martyred. Their faith's power though, to guide and deliver them pales when compared to the Egyptian and Etruscan faiths, who receive advanced warning of the disaster. Christian theology includes warnings for its faithful when corrupt cities or civilizations are going to be destroyed, like Sodom and Gomorrah and Egypt. While the novel does show Christians in a favorable manner, it missed the chance to have Apæcides or Olinthus receive a premonition of the eruption. They could have shepherded the faithful and the converts out of the city, while the decadent Romans reveled in blood-sport their doom approaching. Contemporary readers noted the mixed message, like Sumner Lincoln Fairfield. Fairfield criticized Bulwer-Lytton for what he saw as the loose morality of the novel (Rowland 138-39). The novel did not correctly deliver the appropriate message of salvation or wrath. Fairfield wrote his own narrative version of the destruction of Pompeii, "The Last Night of Pompeii" (1832), which is perfectly moral, as the Christian lovers easily escape the eruption of the volcano while

the pagans all die (Rowland 139). Faith in the novel is not constructed in a fashion that turns the eruption into a religious symbol.

Volcanoes have been a feature of the faiths that lived near them (Sheets 1314). They were written into networks of human meaning, with giants or gods living under mountains, delivering messages through eruptions. *The Last Days of Pompeii* takes place during that period, when Vulcan's smithy was still under Etna. The novel focuses on the sins of the classical period (slavery, gluttony, gladiatorial combat, etc.) and the conversion of the people to Christianity in the face of God's wrath. The eruption though does not close the novel. Vesuvius stops erupting in chapter nine of book five, but the novel ends two chapters later. The last is split into two parts: the first part is a letter from Glaucus to his friend Sallust and the second part returns to the third-person omniscient narrator. In the letter, Glaucus reveals his complete conversion to Christianity: "You speak of the growing sect of the Christians in Rome. Sallust, to you I may confide my secret; I have pondered much over that faith—I have adopted it" (E. Bulwer-Lytton 510). Glaucus says that his survival during the eruption, the fact that he was not eaten by an escaped lion, and his conversations with Olinthus changed his mind. The novel could have ended there: the main character and his love having survived the catastrophe and found God. But it does not.

Bulwer-Lytton outlines the fates of all the secondary characters that were running about during the eruption: they all died. He also points out the various buildings that he mentioned in the story and whether or not they still stand. He ends with "Viewing the various witnesses of a social system which has passed from the world for ever—a

stranger, from that remote and barbarian Isle which the Imperial Roman shivered when he named, paused amidst the delights of the soft Campania and composed this history!" (E. Bulwer-Lytton 513). Instead of ending with Glaucus and his acceptance of Christianity, Bulwer-Lytton ends with the dead and his rediscovery of Pompeii. Using faith to explain disasters is a human pattern. *The Last Days of Pompeii* though suggests that ancient faiths are more powerful than modern ones by having the Egyptian and the Etruscan faiths receive warnings about Vesuvius. The novel is not encouraging its readers to turn to the worship of Isis, but *The Last Days of Pompeii* does not support a religious reading. The characters say that Vesuvius is the wrath of God. No evidence supports that claim. Throughout the eruption, the volcano was a variety of objects: a manifestation of wrathful Nature, the hand of God, a portal to the underworld. Vesuvius for the characters of the novel is canvas for human meaning. But Vesuvius for the readers of the novel is natural phenomenon. The ending prevents Vesuvius from being meaningful. The eruption spurs some Romans to convert, but not all. The pyroclastic flows kill indiscriminately; Christians are not spared because of the power of their faith. The end of the novel emphasizes the burial of the city, its rediscovery, and the passage of time, not the transcendental power of faith. The volcano is merely an event which punctuates the action. Vesuvius is meaningless for the readers; it is not part of a human system and is instead closer to a natural system.

2. History and Aesthetics

Both Wood and Daly, above, note that volcanoes were a popular topic in early nineteenth century. *The Last Days of Pompeii* is an interesting entry in volcanic-oriented texts because of the way that it pushes against faith. The end of the novel focuses on the layering of volcanic ash over human civilization, on the cycle of growth and death, not on the transcendence of faith. Decoupling volcanoes from revolution and religion in the early nineteenth century relied on more than just showing that volcanoes did not seem to respond to questions of faith. History and aesthetics were also valuable sources of evidence to place volcanos in the environmental system, away from the human dichotomy of nature and culture. *The Last Days of Pompeii* uses both history and aesthetics to help show how volcanoes were not controlled by human systems of meaning as did the *Principles of Geology*. Charles Lyell's *Principles of Geology* was another source of knowledge for a volcano-hungry public. If the *Last Days of Pompeii* were on a best seller list for fiction at that time, then the *Principles of Geology* would be on a concurrent list for non-fiction. Between 1830 and 1875, *Principles of Geology* went through twelve editions and even then "the work continued to sell well" ("Lyell and the *Principles of Geology*" 13). When *Last Days of Pompeii* was published, *Principles of Geology* was already in its third edition. Lyell's central argument in *Principles* is that the earth is gradually changing, a theory that would be called uniformitarianism. Volcanoes were valuable evidence for Lyell, thanks to Hamilton as noted in the previous chapter.

Lyell devotes significant space in to their explanation; roughly five chapters out of twenty-six are dedicated to the discussion volcanic phenomena.

In the first edition, volcanoes are introduced fully in chapter eighteen. Before chapter eighteen, Lyell discusses how water erodes and transports rock, thus leading to gradual changes in the shape of the planet. He starts chapter eighteen by proposing to consider igneous action in the same uniform fashion as aqueous, assuming that both forces have been operating over time and will continue to because "if there be no instability in the laws of Nature, similar fluctuations must recur again and again in time to come" (Lyell 313). Lyell pauses to criticize the geologists who disagree with him arguing that they "refuse to conclude that great revolutions in the earth's surface are now in progress, or that they will take place *because* they have often been repeated in former ages, but assume the improbability of such a conclusion" (Lyell 313-14). Lyell's opponents see evidence of former transformations and use that as evidence against the same transformation happening again. Lyell disagrees with that logic. Volcanoes are important to Lyell because they demonstrate a continuous cycle of silence and activity. Like Hamilton, Lyell states that to fully grasp volcanic cycles one need "wait for at least six times as many centuries as have elapsed since the discovery of America" (Lyell 315). Time, again, is an important component to make volcanoes visible. Writing allows Lyell to suggest thousands of years to his readers. To see volcanoes, one needs to view a breadth of history. Humans though live for a short time and so *Principles of Geology* works to help its readers see the centuries. Lyell also maps the volcanoes of the world for his readers, laying out a vast igneous network over pages. He notes though that his map

may not be complete: “Had southern Italy been known to civilized nations for as short a period as America, we should have no record of eruptions in Ischia” (Lyell 325). The last time Ischia, off the coast of Naples, erupted was 1302 (“Ischia”). Without a historical record, a record of time, Ischia would be invisible. Once Lyell is done with his global mapping of volcanoes, he focuses on the nature of geologic change over time in Naples.

Part of Lyell's argument for starting with the Campanian volcanic arc is time. Naples has better historical records: “By far the most connected series of records throughout a long period relates to the first of these districts [Naples]” (Lyell 326). The famous records of volcanic activity around Naples help show how Vesuvius has operated over time. He starts his discussion of the Campanian volcanic arc by recalling the earliest inhabitants, the Greeks, the Erythæans, Chalcidians, and the Siracusani. He notes that these people were often driven away by the frequent eruptions (Lyell 327). The use of human records, not merely rocks, is important for a more complete picture of historical volcanic eruptions. Even modern volcanologists use written records alongside rocks. Oppenheimer notes that changes in the weather due to volcanic eruptions, like the coloration of sunsets, “did not go unnoticed to astute astronomers, scientists and historians of the past, and their documentation represents another rich source for volcanological and climatological data mining” (Oppenheimer 139). The connection between geological and cultural records is not only a benefit for science. The connection reflects on culture making volcanoes visible through time. Vesuvius’ eruptions spread through culture happening not just in 79 CE, but also 203, 472, and 1631. Lyell uses history to emphasize his point that even if a volcano looks extinct it might not be. Lyell

does not start off with a description of how Vesuvius works, but with a recitation of the human connection to the Campanian volcanic arc. Humanity is not excused from geologic process in Lyell's work. Like Bulwer-Lytton, Lyell moves human societies into Vesuvius's sphere of influence, moving Vesuvius out of a sphere of human-focused meaning. After describing other igneous features around Naples and their human connections, Lyell says "we then arrive at a crisis in the volcanic action of this district—one of the most interesting events witnessed by man during the brief period throughout which he has observed the physical changes on the earth's surface" (Lyell 330) the infamous 79 CE eruption of Vesuvius.

Lyell notes that Vesuvius did not look like a volcano to the colonizing Greeks, highlighting time once again. The features of volcanoes had been written down by Strabo, Lyell claims, but Vesuvius was camouflaged by time: "The ancient cone was of a very regular form, terminating, not as at present in, two peaks, but with a flattish summit, where the remains of an ancient crater, nearly filled up, had left a slight depression, covered in its interior by wild vines, and with a sterile plain at the bottom" (Lyell 330). Volcanoes have an iconic form: a mountain with a smoking, conical depression at the top. Vesuvius did not match that form, making it invisible to the colonists. Time and geography, from the beginning of human history until the early nineteenth century, obscured volcanoes. Lyell shows how people can fall victim to misunderstanding the process of the earth's systems. Lyell then paints a bucolic picture of Pompeii and Herculaneum, saying they were populated and had planted "fertile fields" on the flanks of the mountain. Following this idyllic scene, Lyell says grimly "But the scene of repose

was at length doomed to cease, and the volcanic fire was recalled to the main channel" (Lyell 330). From there Lyell launches into his analysis of the eruption of Vesuvius, which has striking similarities to *The Last Days of Pompeii*.

The historical record that Lyell uses is similar to Bulwer-Lytton's. Both men cite Roman writers, like Pliny and Dion Cassius, to inform their works. Lyell starts his description of the eruption of Vesuvius with a note about previous volcanic activity: "The first symptom of the revival of the energies of this volcano was the occurrence of an earthquake in the year 63 after Christ, which did considerable injury to the cities in its vicinity" (Lyell 330). Bulwer-Lytton uses the same earthquake for foreshadowing. The first reference to the 63 CE earthquake in *The Last Days of Pompeii* takes place while Arbaces is admiring his new temple to Isis: "That edifice was then but of recent erection; the ancient temple had been thrown down in the earthquake sixteen years before" (E. Bulwer-Lytton 40). Bulwer-Lytton goes on to mention the earthquake at least four more times (E. Bulwer-Lytton 140, 182, 194, 447). The earthquake references also foreshadow the other igneous activity in the book. Continuing with Lyell's description, he notes that there were earthquakes right before the eruption (Lyell 330-31). These earthquakes are a major plot point in the novel as they save Glaucus' life. To protect Ione from rape, Glaucus attacks Arbaces (E. Bulwer-Lytton 179). Arbaces gains the upper hand and is about to stab Glaucus when: "IT woke—it stirred—that Dread Demon of the Earthquake—laughing to scorn alike the magic of human guile and the malice of human wrath" (E. Bulwer-Lytton 182). The ground shakes, shifting people, buildings, and objects including a statue of Isis: "the sable head of the goddess tottered and fell from its

pedestal—and as the Egyptian stooped above his intended victim, right upon his bended form, right between the shoulder and the neck, struck the marble mass!" (E. Bulwer-Lytton 182). In a stroke of irony, Arbaces' own idol knocks him out. With further irony, this time dramatic, Glaucus praises the earth "'The Earth has preserved her children,' said Glaucus, staggering to his feet. 'Blessed be the dread convulsion! Let us worship the providence of the gods!'" (E. Bulwer-Lytton 182). Both writers use history to connect their work with the volcanic record. They contextualize the operations of Vesuvius and in the process show that volcanoes are merely environmental phenomena. Historical records, as Lyell noted, help people see the scope of volcanic action.

Another source Lyell looks to is Pliny the Younger, who famously recorded his observations of the 79 CE eruption of Vesuvius. Pliny's contribution to volcanology is recognized in the term Plinian Eruption, which refers to an eruption like Vesuvius in 79 CE, Tambora in 1815, or Krakatoa in 1883. Lyell paraphrases Pliny's letter to Tacitus to describe the eruption of Vesuvius "A dense column of vapour was first seen rising vertically from Vesuvius, and then spreading itself out laterally, so that its upper portion resembled the head, and its lower the trunk of the pine [...] This black cloud was pierced occasionally by flashes of fire as vivid as lightning, succeeded by darkness more profound than night" (Lyell 331). Bulwer-Lytton poetically cites the same passage from Pliny: "a vast vapor shooting from the summit of Vesuvius, in the form of a gigantic pine-tree; the trunk, blackness—the branches, fire!—a fire that shifted and wavered in its hues with every moment, now fiercely luminous, now of a dull and dying red" (E. Bulwer-Lytton 480). There is even a footnote on that page of the novel crediting Pliny.

Pliny's observations show the cyclical nature of Vesuvian eruptions. Vesuvius was not reacting to the state of the towns around it, just reacting to pressures below. The use of Pliny in both science and art also demonstrates the cross cutting nature of volcanoes. Volcanic action is important to both science and culture. The interdisciplinary nature of volcanoes is noted by Oppenheimer, who says that he is "fascinated by the intersections of geology, climatology, ecology, archaeology and anthropology" (Oppenheimer xii) that cross volcanoes. Oppenheimer's fascination is important: the crosscutting nature of volcanoes means that only manifold knowledge can help people understand them; art draws on science and science on art.

Bulwer-Lytton, in addition to citing on Pliny, also used scientific knowledge of the era to further his novel: "It is virtually certain that he was aware of the volcanological research of his British contemporaries" like Sir Humphry Davy, George Poulett-Scrope, and of course Charles Lyell (Sigurdsson and Lopes-Gautier 1340). Bulwer-Lytton's scope is not a surprise, as he believed that art and science had similar processes of inquiry (Mitchell 132). Accordingly, Bulwer-Lytton adopts a scientifically based approach to the destruction of Pompeii. The iconic rivers of molten rock that cascade down the side of volcanoes are spectacular. But Bulwer-Lytton avoids those rivers and kills his protagonists off with pyroclastic flows. Bulwer-Lytton even add a note that "showers of ashes and boiling water, mingled with frequent irruptions of large stones, and aided by partial convulsions of the earth" (E. Bulwer-Lytton 1834 413) are the most accurate way of illustrating Pompeii's destruction, rather than lava flows. Lyell concurs saying, "It does not appear that in the year 79 any lava flowed from Vesuvius; the ejected

substances, perhaps, consisted entirely of lapilli, sand, and fragments of older lava" (Lyell 332-33). The facts of the eruption of Vesuvius give Bulwer Lytton purchase to both fictionalize the eruption but also help him show readers the true danger of volcanoes. Rather than giving his readers lava flows running through the streets of Pompeii, Bulwer-Lytton's use of ash clouds would help the reader connect with the descriptions they read in travelogues or saw themselves. The verisimilitude furthers Bulwer-Lytton's art, but also helps show the complex nature of volcanoes through science and history. As Bulwer-Lytton draws upon science to help his novel resemble reality, Lyell draws upon aesthetics to increase the sensation of his work.

Lyell uses aesthetics to further his argument about the constant and uniform change of the earth. After describing the environment around Monte Nuovo, a cinder cone of the Phlegraean Fields caldera, Lyell waxes poetic: "every part of the picture is in perfect harmony with the rest, that the whole has the appearance of having been called into existence by a single effort of creative power. What other result could we have anticipated, if Nature has ever been governed by the same laws?" (Lyell 337). Lyell sets up a link between divine creation and uniform laws: only a consistent set of natural laws written by God could produce uniformity. Lyell's description uses picturesque aesthetics, emphasizing harmony and a lack of redundancy, as evidence for his claim of uniformity. He continues, saying "Were it true that the greater part of the dry land originated simultaneously in its present state, and that additions were afterwards made slowly and successively; then, indeed, there might be reason to expect a strong line of demarcation between the signs of ancient and modern changes" (Lyell 337). Lyell sets his aesthetic

observations against Neptunian theory by using the volcano as a temporal erratic. If the earth was formed only once and volcanoes erupted later at different points, then the landscape should be inharmonious because there would be defined lines of aging lava. A Neptunist might retort that erosion has subsequently harmonized the landscape. If they did, though, they would be admitting that erosion operates similarly throughout time, part of the uniformitarian argument. Lyell uses aesthetics to define the qualities of the earth, helping him prove his scientific point. Aesthetic data is valuable to Lyell's claim and without them he might not have been able to sufficiently argue for his thesis.

Lyell uses the two chapters to cover Vesuvius, and other parts of the Campanian volcanic arc. The chapters further establish Lyell's own geologic theory: that the earth is slowly changing. A variety of sources of knowledge are key to Lyell's success. Through empirical observations, historical records, aesthetic determinations, and other evidence, Lyell proves his argument about the nature of volcanoes and renewal of the planet's surface (Lyell 359). Bulwer-Lytton makes use of similar sources to help dramatize the historical eruption of Vesuvius. Both writers deploy knowledge to help better understand their world and its past. Knowledge is an important key to volcanoes. Knowledge of volcanoes, even just their history, provides a chance to reduce risk. The characters in *The Last Days of Pompeii* are in sharp contrast with Bulwer-Lytton and Lyell, as the former eschew knowledge where the latter embrace it. Bulwer-Lytton thought that in both literature and science, knowledge "is the legitimate aim of our intellect" (R. Bulwer-Lytton 420-21). The fact that his characters all reject knowledge, though, highlights the

importance of knowledge in the face of volcanism: knowledge of volcanoes has more meaning in the face of an eruption than human networks of morality or faith.

3. Knowledge

The characters of *The Last Days of Pompeii* have a strange relationship with knowledge, especially scientific or even pseudo-scientific knowledge. The word science had a more fluid meaning when the novel was published according to the *Oxford English Dictionary*. On one side, science was starting to mean the use of method to attempt to demonstrate some truth about the material world. On the other side science also meant any "Knowledge or understanding acquired by study; acquaintance with or mastery of any branch of learning" ("science, n."). The usage in the novel is confused at times, but the latter definition dominates. Bulwer-Lytton thought that knowledge was valuable, but the Pompeiians of his novel did not. Most of the characters draw a distinction between knowledge and other parts of life. In an early chapter, Glaucus tells one of his friends that "pleasure and study are not elements to be thus mixed together, they must be enjoyed separately" (E. Bulwer-Lytton 7). And Pompeii does not seem to be a city of study but a city of pleasure. The plot of the novel focuses on gambling, bathing, walking, parties, gladiatorial combat, and love, not study. Glaucus' poet-friend only reads because he is either too hung-over or lazy to do anything else before noon, not out of a desire for knowledge (E. Bulwer-Lytton 309). The Pompeiians of the novel ignore knowledge because they have other fascinations to occupy their time. Glaucus and Ione, after the

earthquake which saved their lives, spend their time cavorting "beneath the fatal mount of Vesuvius. The earth shook no more; the lively Pompeians forgot even that there had gone forth so terrible a warning of their approaching doom. Glaucus imagined that convulsion, in the vanity of his heathen religion, an especial interposition of the gods" (E. Bulwer-Lytton 215). Rather than seeing the earthquake as a terrestrial event, Glaucus believes it is a human one associated with the gods. Rather than wondering what the earthquake might foretell, the Pompeiians forget about it. Rather than preparing themselves, Glaucus and Ione cavort. The dramatic irony of the passage makes the characters seem willfully ignorant. If the flaw of the protagonists is that they do not seek knowledge, as Vesuvius is rumbling and shaking, then the flaw of antagonists is that they have all the knowledge but do not act on it.

Arbaces is the best example of the complex relationship the novel has with knowledge. He is both a priest and a scientist; he has knowledge yet does not use it. The *British Quarterly Review* describes Arbaces, saying that he is a

> priest, atheist, king, conjuror, patriot;– he is an astrologer, a philosopher, a voluptuary, and an assassin;– a passionate idolator of the name and celebrity of Egypt, and a great proficient in the modern schools of philosophy. Very scientific, he has divined the existence of America; and sublimely ambitious, he has resolved to be the founder in that other world of a new dynasty. ("The Novels of Sir Edward Lytton Bulwer" 386)

Arbaces is a bundle of contradictions, both an atheist and a priest, both an idolater and a philosopher. The magazine suggests that Arbaces is too proficient or talented for the novel. He is too good of a villain. Interestingly, the review categorizes Arbaces as scientific. He does not practice science like a nineteenth-century natural philosopher, but he driven to know more: "he sought to raise himself by the cultivation of knowledge" (E.

Bulwer-Lytton 165). And Arbaces does have a methodology that explains the world sufficiently: “He had filled his scroll, he had noted the moment and the sign; and, leaning upon his hand, he had surrendered himself to the thoughts which his calculation excited. ‘Again do the stars forewarn me! Some danger, then, assuredly awaits me!’ said he, slowly; ‘some danger, violent and sudden in its nature’” (E. Bulwer-Lytton 159). Even though this is an astrologers’ method, Arbaces calculates his own doom successfully. Therefore while Arbaces’ method is in no way actually scientific, he is gathering knowledge and coming to surprisingly accurate conclusions. But Arbaces does not seem to know that he is pushing against the limits of human knowledge.

The narrator castigates Arbaces and his pursuit of knowledge, noting that “He did not know (perhaps no one in that age distinctly did) the limits which Nature imposes upon our discoveries. […] Thus he pursued science, across her appointed boundaries, into the land of perplexity and shadow” (E. Bulwer-Lytton 165). The criticism that the narrator levels at Arbaces touches on a developing trope: the mad scientist. The most infamous version of the trope was introduced by Mary Shelley in *Frankenstein* (1818). Like Victor Frankenstein, Arbaces does not understand that there is a limit on how much one should discover. He assumes that by understanding nature, he will be able to control it. Therefore he pursues knowledge, believing that humanity can obtain god-like powers. A similar understanding is outlined for Victor when he is at the University of Ingolstadt by the chemist Waldman. Waldman tells Victor that the power of modern science over ancient pseudo-science, is that modern science can truly control the natural world. Waldman’s language is the same as the narrator’s for Arbaces: “They [modern scientists]

penetrate into the recesses of nature, and shew how she works in her hiding places. They ascend into the heavens; they have discovered how the blood circulates, and the nature of the air we breathe. They have acquired new and almost unlimited powers" (Shelley 28). Both of these two quotations recall passages from Francis Bacon's *Novum Organum* (1620), such as section XVIII where Bacon notes that modern science can help "penetrate" into the "recess of nature" (Bacon 50) or that to control nature one must understand and "obey" nature (Bacon 47). The knowledge that these two gain does help them learn and accomplish new feats. Waldman's training helps Victor eliminate the barrier between life and death, and create the Creature. Arbaces accurately manages to predict a volcanic eruption. Neglect though is a feature of the mad scientist. Obviously, Victor neglects the Creature, resulting in a string of murders. Despite his predictions and multiple warning about the impending eruption of Vesuvius, including being told by the hag that he needs to flee, Arbaces neglects to save his own life.

Arbaces appears to succeed in his efforts to reveal the workings of nature: he learns of Pompeii's impending doom. Accordingly, the narrator goes to some effort to criticize Arbaces for his knowledge, noting that Arbaces passed the ethical boundary of science. This criticism continues later in the novel when Arbaces has a dream where he meets Nature. Nature also criticizes him for his overreach: "Dark fool of the human sciences! dreamer of the stars, and would-be decipherer of the heart and origin of things! those lights are but the glimmerings of such knowledge as is vouchsafed to Nature to work her way, to trace enough of the past and future to give providence to her designs" (E. Bulwer-Lytton 444). Nature points out the limits of Arbaces's knowledge, that despite

all that he has uncovered, he still does not know or understand the world completely. The narrator also points out that Arbaces' search for knowledge was self-serving (E. Bulwer-Lytton 165). Perhaps, had Arbaces understood the world or cared about others he would have actually fled from Pompeii and Vesuvius.

His narrative is very similar to that of a protagonist in Greek drama: a man who knows his fate, but chooses to ignore it because of his hubris. Were the novel trying to proselytize against hubris, then Arbaces's death despite his knowledge would fit. But the doom that Arbaces is facing is not personal, nor specific to him. His doom is just the result of the collision of the Eurasian Plate with the African Plate. Nevertheless, Arbaces had the knowledge which could have saved his life or the lives of the people of Pompeii. The volcano has to erupt and be catastrophic because the novel is historical. Giving Abraces access to the knowledge does not seem to reinforce his villainy, though: it just makes him seem short-sighted and dumb. Both the protagonists and antagonists of the story demonstrate the two most dangerous attitudes towards knowledge when confronting environmental catastrophe. The protagonists are uninterested in knowledge. The antagonists refuse to use their knowledge. Bulwer-Lytton sets up this dichotomy to help show how important material knowledge is to living with volcanoes. Knowledge is the only real defense against volcanic catastrophe, a point that is not lost on either Bulwer-Lytton or Lyell.

Knowledge is especially important to communities living with volcanoes. Historical knowledge of volcanoes is important if communities want to minimize the loss of life. Modern volcanologists point out that having access to knowledge is key to

predicting and preparing for volcanic eruptions. Oral traditions "can provide valuable information for modern scientific understanding of past volcanic activity, as well as inform present-day management of volcanic risks" (Oppenheimer 123). One example of the value of multi-faceted knowledge is the eruption of Mount Pinatubo, in the Philippines, in 1991. Like Vesuvius, many had forgotten that Pinatubo was volcano. The exception were the indigenous Aeta people. They have a story where a spirit of the sea takes refuge in a lake atop Pinatubo and from it hurls rock, mud, and ashes. The story warns that even though it might look like the spirit of the sea is dormant, it is always waiting to cause havoc again (Oppenheimer 124). Had Pinatubo been recognized earlier through poetry and myth then its impact would have been reduced. Once a community recognizes a volcanic threat the only answer is preparation because predictions are of limited value (Oppenheimer 328). Even though Pliny the Elder did not believe that Vesuvius was active, many other writers noted its nature. The areas around Vesuvius is called Phlegraean Fields, which means 'Burning Fields' suggesting that whoever colonized knew of the igneous activity (Sigurdsson 51). Written records indicate that there was an eruption in 217 BCE (Sigurdsson 56). Vitruvius in 16 BCE said "Let it be recorded, that heats in antiquity grew and abounded under Mount Vesuvius, and thence belched forth flame round the country" (Sigurdsson 51). Strabo, who lived between 64 BCE and 25 CE, noted that Vesuvius was formerly a burning mountain (*Vulcan's fury* 27). Although Seneca expressed shock when the 62 earthquake hit (Sigurdsson 51), there was surely enough evidence to conclude the Vesuvius was not as quiescent as Pliny the Elder had assumed.

Yet, as with Pinatubo, no one thought that Vesuvius was a volcano or was willing to believe that it had reawakened despite ample evidence (Lyell 330). Lyell's implication is that had people used that evidence perhaps they would not have built so close to Vesuvius or would have been better prepared. Historical reconstructions of Vesuvius' 79 CE eruption claim that people fled the city before the eruption. There were few skeletons and valuables remaining in Pompeii, which suggests that most people must have left before the pyroclastic flows (Lyell 354, Rowland 168). Therefore Pompeiians must have had evidence that caused them to flee. The novel does not duplicate reality in regards to the evacuation of Pompeii. No one heeds the warning signs, like the earthquake (E. Bulwer-Lytton 181) or the cloud hanging over Vesuvius (E. Bulwer-Lytton 198). Instead they flee once the volcano begins erupting (E. Bulwer-Lytton 480). The flight of the citizens of Pompeii in the novel is dramatic. The discrepancy between the fiction and the accepted history of Pompeii further emphasizes knowledge. The real people of Pompeii used empirical evidence to escape and save their own lives, whereas the fictional characters are too caught up in blood sport to consider leaving. While the novel is still a critique of the excess of Roman civilization and corruption, it also is critical of the people of Naples in the nineteenth century. Unlike Pompeii, Vesuvius was still as active in 1834 as it was in 79 CE.

Bulwer-Lytton himself laments that the current residents around Vesuvius build as though it were extinct, despite evidence to the contrary. As Arbaces is surveying the city, the narrator notes that "Villas and villages stretched on every side up the ascent of Vesuvius, not nearly then so steep or so lofty as at present" (E. Bulwer-Lytton 163). In a

book about the historical destruction of a city around a volcano, the narrator critiques the new buildings around the same volcano. The criticism is not hidden, Bulwer-Lytton goes on to say that people continue to build around a "volcano whose fires they believed at rest for ever" and that Vesuvius is a constant threat but "man is blind—that which was to come!" (E. Bulwer-Lytton 163). So the critique is not merely aimed at Romans, but also Europeans in the early nineteenth century, because despite knowledge of Vesuvius, people continued to live in the shadow of a volcano. Bulwer-Lytton's mixed use of both faith and knowledge in *The Last Days of Pompeii* shows that one of the goals of the novel is not to evoke the famed city, but to remind British readers of the danger of the environment. Pompeii is not a tragedy, but an object lesson. Vesuvius has no particular meaning in the novel, because if it did the warning would be lost. Yet people continued and continue to live in this geologically dangerous area.

Lyell suggests that people continue to live around Vesuvius because no location "combines the same advantage of proximity to the capital, to the sea, and to the rich lands on the flanks of Vesuvius" (Lyell 358-59). The area around Vesuvius is too tempting: there are too many advantages like the moderate climate and the fertile soil. For Lyell part of the problem is thought process. He thinks that other geologists are promoting the idea that the fundamental mechanisms of the Earth have changed, therefore people do not need to worry. The earth is no longer in its chaotic, primeval state, which means no more catastrophes. Lyell says that these people "when they consider the numerous proofs of reiterated catastrophes to which the region was subject, they may, perhaps, commiserate the unhappy fate of beings condemned to inhabit a planet during its nascent and chaotic

state, and feel grateful that their favoured race escaped such scenes of anarchy and misrule" (Lyell 360). Lyell is criticizing the theories of the catastrophist geologists, like Georges Cuvier, who suggested that the earth was more energetic, more disastrous in the past. For Lyell that is a grave miscalculation, as it means that people will believe themselves safe when they are not. The failing is that human beings consider themselves only part of a human system of time, where the only operations possible are those that occur on that scale. Thus the only possible earthquake is one that has occurred in recent history, and the only possible eruption is one that occurred recently. The kinds of eruptions that happened in the ancient past are confined there. This kind of thinking excuses human societies from natural systems; only human time has importance and knowledge from the past is not insightful for modern problems. Therefore Lyell thinks it is important that people recognize that the laws that govern the Earth have not changed. Knowledge of Vesuvius's previous eruptions and of the mechanisms of the earth, for Lyell and Bulwer-Lytton, are crucial because all of these can help prevent life loss in the future.

The misuse of knowledge in the novel is an important message about volcanoes: while the characters in the story do not pay attention to knowledge about the volcano, the reader of the book is in a position to use the volcanic knowledge they gain. As both Bulwer-Lytton and Lyell point out, people still live next to and around Vesuvius. Even today the area around Vesuvius is heavily populated (Rowland 285) and when Vesuvius experiences another VEI six or seven eruption, the loss of life around Naples will be very high (Oppenheimer 323). This is not to say, though, that contemporary British readers

were aware or should have been aware of volcanoes because they needed to protect their lives and communities. The last time a volcano erupted in the United Kingdom was long before *homo sapiens sapiens* even existed. The importance of an increased awareness of volcanoes was as an indicator: despite daily evidence of a static earth, the ground was really moving constantly. Even if people thought that a particular phenomenon was unlikely to occur again, understanding the scale of geological time meant that it might. Knowing about volcanoes, because they represent a threat, also means connecting with the new scientific paradigm where volcanoes were just one representation of the changes the earth was constantly undergoing regardless of people.

Fortunately, popular media helped push volcanic awareness through rapid modes of communication that were available in the early nineteenth century. A British reader could learn about volcanoes and their deadly impact from a variety of books and newspapers. Ideas and theories of volcanism became more wide spread than ever. An article in 1830 claims that a "partial volcanic eruption of the earth [...] is said to have taken place in the parish of Lenham, near Grafty Green, in the county of Kent" ("Volcanoes"). A volcano did not appear in Kent in 1830. What the articles describes sounds like either an earthquake or a sinkhole. Still, the writer compares the situation in Kent with volcanoes from around Europe. And they quote from Hamilton's account of the 1766 eruption of Vesuvius. Even for this mistaken volcano, comparisons to other volcanoes and the usage scientific knowledge show how networks of volcanoes were being built even in the popular press. Around 1832 papers begin to report earthquakes near Vesuvius ("Italy") and then in 1834 reports of an eruption appear. The articles are

hyperbolic saying the eruption “surpassed every thing which history has transmitted to us” (“Foreign”). The writer of the article says that thousands of families were displaced, fifteen hundred buildings were destroyed, along with 2500 acres of land (“Foreign”). Twenty-first century accounting claims that eight hundred were left homeless and about 3.8 million square meters were covered in lava, comparable to the writer's accounts (“Catalogo storico delle eruzioni del Vesuvio dal 1631 al 1944”). Although the statement about the eruption being larger than anything in history is still overblown. These newspaper reports helped expand the visible network of volcanoes, and suggested that volcanoes were merely a phenomena not a symbol. Newspapers reported on the explosion of Tambora, and other volcanos throughout the world, like the eruption of a volcano on the Kamchatka Peninsula (“Foreign Intelligence”) or any number of eruptions in Italy or Iceland increasing the profile of volcanoes. No longer were they limited to two or three mountains in Italy. Volcanoes were all over the world, they were similar, and they were violent.

The *Last Days of Pompeii* and the *Principles of Geology* are the most salient works on volcanoes from the 1830s. Many readers learned about volcanoes, their effects and mechanics through Bulwer-Lytton and Lyell. As mentioned above, Lyell's *Principles* went through many reprintings. And Bulwer-Lytton's novel was quite popular not only in English language sales (Harris 168) and translations (Harris 171), but also in adaptations. Less than a year after publication, *The Last Days of Pompeii* was turned into a play: “A new burletta [*sic*], called *The Last Days of Pompeii*, founded on the novel of that name, was produced at this theatre [the Adelphi] on Monday night” (“The Theatres” 29 Dec

1834). The Victoria Theater was also performing an adaptation of Bulwer-Lytton's novel. A newspaper review says of the production that "the story of the first piece is doubtless well known, and therefore we shall only remark that the scenery was splendid, particularly the representation of an Eruption of Vesuvius, the acting generally good, and the applause of the audience unmixed" ("The Theatres" 28 Dec 1834). The review suggests that Bulwer-Lytton's novel is well known among the theater-going public.

Pompeii and Vesuvius were a popular topic at that time (G. Wood 33). Bulwer-Lytton was not the first artist to undertake a dramatic retelling of Pompeii's fate. In 1825 the opera "L'ultimo giorno di Pompei" with music by Giovanni Pacini and the libretto by Leone Andrea Tottola, premiered at the Royal Theater of San Carlos (Coates, Lapatin, and Seydl 197). While a few of the characters share the same names between the opera and the novel, the plot is quite different from Bulwer-Lytton's. The opera was still being performed in 1830, although *The Observer* notes that the story is "excessively absurd" ("French Dramas and Theatricals"). Bulwer-Lytton might have seen or at least heard about one of the productions. Karl Pavlovic Briullov's painting "The Last Days of Pompeii" was a definite influence upon Bulwer-Lytton's work. Bulwer-Lytton saw the painting while in Milan in 1833 (Harris 166). The painting shows a crowd of terrified Pompeiians fleeing, while a red and black Vesuvius erupts ash and lava in the background. Work became one of the most famous pieces of nineteenth-century art (Rowland 135). Bulwer-Lytton's novel was one entry in a body of art that focused on the misfortune of those living around Vesuvius in 79 CE. Pompeii, Vesuvius, and volcanoes in general were popular subject matters. They served as an easy metaphor for revolution,

a salient topic at the time. Volcanoes were also popular in the nineteenth century because of increased recognition, a more systematic vision of volcanoes throughout the planet, and a greater respect for their power.

Despite volcanoes' historical significance as mythological or religious locations, and despite their value in similes, they were beginning to take on their own existence in the nineteenth century. Both *The Last Days of Pompeii* and *The Principles of Geology* grant volcanoes their own role. They do not categorize them as a features of human social systems. Neither Lyell nor Bulwer-Lytton ascribe human-focused meaning to Vesuvius. The two texts here divest volcanoes of any human significance. The texts are part of a shift in interpreting volcanoes: as the nineteenth century moved on, volcanoes would be seen as a feature of the natural systems and not a part of human systems. Multiple cultural sources attest to this change. A newspaper report on Humphry Davy's expedition to Vesuvius says that his research "and several other experiments gave reason to hope, that we may at least discover something relative to the cause of these volcanos, over which Nature has hitherto thrown a veil" ("Mount Vesuvius"). The hope and the desire of writer is to understand the mechanics of volcanoes; they do not have a meaning in mind. The hope is that Davy will be able to uncover the mechanism. Davy himself, like Lyell, in "On the Phenomena and Causes of Volcanoes" (1811) gives his theory of volcanic action. He notes that volcanoes reveal some facts, because a volcanic eruption "affords the only known facts of the agency of heat upon rocks that occur on a great scale; it exhibits to us the grandest of the operations of natural chemistry, and it offers a rich, and

as yet almost an untouched field of discovery" (Davy 225). As a chemist, Davy see the volcano as an important source for chemical knowledge.

Many discussions of geology did confirm a sense of meaning for the actions of the earth and theology: studying the earth was a way of demonstrating the intricacies and depth of God's creation. Geology was not interested in precisely demonstrating biblical fact (Porter 64) but some geology was used to reinforce "traditional cosmogony, rather than challenging it" (Porter 65). Other geologists, though, tried to keep divinity far away from geology to escape any heated debates (O'Connor 18). Lyell was interested in separating geology from theology (O'Connor 164-65). Lyell notes, in regards to the destruction of Pompeii and other settlements around Vesuvius, "The principals evils which they [the inhabitants] have suffered must be attributed to moral, not to physical causes—to disastrous events over which man might have exercised a control, rather than to the inevitable catastrophes which result from subterranean agency" (Lyell 360). Lyell is saying that the Pompeiians had control over how they lived their lives and what they did, but there was no way their actions might have stopped the eruption of the volcano.

The Last Days of Pompeii destabilizes volcanic meaning by questioning the significance of faith in environmental systems, by using history and science to ground the catastrophe in reality, and by emphasizing the importance of knowledge as the only defense against eruptions. *The Principles of Geology* using very similar evidence, placing Vesuvius and volcanoes in a system of time that stretches beyond human lives, reminding readers that the changes in and around the mountain are inevitable. These texts set up a world that is larger than human societies: shifting, changing, and uncaring. In the face of

new empirical evidence, trustworthy scientific induction, and artistic representations of the human suffering, metaphoric conceptions of volcanoes begin to fall away. The volcano became an object in the world, and not just any kind of object, but one that towered over human life and questioned its primacy, a hyperobject. And before such an object, humanity breaks down: the idea of civilization, which is the separation of human life from nature, ceases. As the volcano erupts in *The Last Days of Pompeii*, Bulwer-Lytton describes the scene saying that "the whole elements of civilization were broken up" and later noting, in evolutionary language "nothing in all the various and complicated machinery of social life was left save the primal law of self-preservation!" (E. Bulwer-Lytton 493). By removing human-focused meaning and emphasizing both knowledge and time, *The Last Days of Pompeii* and the *Principles of Geology* make volcanoes as natural features visible, so that when, in due time, a new volcano would erupt catastrophically human societies would be more mentally prepared to see the forces of the earth at work, and metaphors.

CONSTANCE GORDON-CUMMING AND THE DISAPPOINTING VOLCANO

In 1883 the volcano Krakatoa erupted. Krakatoa was the second largest volcanic eruption in the nineteenth century. The eruption has been the topic of films, television shows, and books into the twenty-first century. [5] Krakatoa occupies much of the discussion of 1883, but seven thousand miles away another volcano was also attracting attention: Kīlauea, the youngest aerial volcano on the Hawaiian Islands. Geologists like James Dwight Dana and Clarence E. Dutton alongside travelers like Constance Frederica Gordon-Cumming, Isabella Bird, and Anna Allnut Brassey helped expand the understanding of the mechanisms of the earth by reporting on Hawai‘i’s unique volcanoes. Also in 1883 Clarence E. Dutton writes one of the first comprehensive geologic reports on the Hawaiian Islands and their volcanoes for the United States Geological Survey. The same year Constance Frederica Gordon-Cumming publishes her travelogue *Fire Fountains: The Kingdom of Hawaii its Volcanoes, and The History of its Missions*. Gordon-Cumming’s account is especially important as she shows readers how to align their perceptions of volcanic action with reality, guiding the reader from disappointment to delight. When she first sees Kīlauea, Gordon-Cumming finds the volcano incredibly disappointing, but then becomes entranced with Kīlauea once it starts erupting. Gordon-Cumming’s experiences show how difficult it is to have someone understand an environmental phenomenon. For volcanoes the asymmetry in understanding is heightened by the violence that is rightly associated with them.

[5] Such as the children’s novel *The Twenty-One Balloons* (1947) by William Pene du Bois; the films *Fair Wind to Java* (1953), *Krakatoa, East of Java* (1969), and *Krakatoa* (2008); the BBC docudrama *Krakatoa: The Last Days* (2006); and the popular history text *Krakatoa: The Day the World Exploded* (2003) by Simon Winchester.

Especially after Krakatoa's eruptions, seeing and thinking about volcanoes like Kīlauea was important to show volcanic action at a comprehensible speed.

First, this chapter will discuss the eruption of Krakatoa, especially the media reports and survivor's accounts. The reports and accounts paint an apocalyptic picture of terrestrial doom. After Krakatoa, the chapter will discuss both historical and modern understandings of the Hawaiian volcanoes, especially Dutton's report to provide context for Gordon-Cumming's narrative. Most of the chapter will then focus on Gordon-Cumming's trip to Hawai'i, especially her excursion to Kīlauea and her stay there. Gordon-Cumming's experiences, especially in contrast with the eruption of Krakatoa, show the importance of reports on volcanoes: without travelogues like Gordon-Cumming's, volcanoes would appear monolithic, and interpretations of them would have narrowed. By experiencing and writing about Kīlauea, especially her initial disappointment, Gordon-Cumming helps to make volcanoes understandable feature of the geologic system for her readers who would otherwise be limited to reports of only explosive volcanism. Reports and narratives of a wide range of volcanoes, which operate at a variety of speeds, helped make volcanoes more comprehensible in time and space in the nineteenth century despite overwhelming volcanic eruptions.

1. Krakatoa

Krakatoa, like Vesuvius, is the result of the subduction of one tectonic plate under another. In Krakatoa's case is a result of the Indo-Australian Plate is being forced under

the Eurasian Plate. The subduction makes Indonesia one of the most volcanically active countries in the world. Indonesia has 140 known volcanoes, compared to Russia which has 152 or the United States which has 174 accord to the Global Volcanism Program ("Database Search"), despite having only about a twentieth or a tenth of the landmass of those countries. Krakatoa, like Vesuvius and Etna, is a composite volcano.[6] Composite volcanoes, due to the nature of their magmas, have an increased "propensity for explosive eruption and the production of pyroclastic material" (Davidson and De Silva 665). Krakatoa was and is no exception: its explosion created one of the loudest sounds on earth. Eugene Murray Aaron, a contemporary editor, translated the size of the explosion by telling his readers that it would be like standing in Philadelphia and hearing an explosion from San Francisco clearly (Winchester 263). The eruption itself, according to Self and Rampino, was "an ignimbrite-forming event of modest volume" (Self and Rampino 703), in other words the eruption was initially not that big. But as the eruption developed though, "four or five large-volume explosions driven by magmatic gases led to collapse of the eruption column" (Self and Rampino 704). The eruption column is the "pine tree" as described by Pliny above a volcano; its collapse caused pyroclastic flows. Self and Rampino claim the pyroclastic flows drove into the sea and caused tsunamis (Self and Rampino 704). The pyroclastic flows and tsunamis killed about 36,600, making Krakatoa the second deadliest volcano in modern human history (Oppenheimer 50).

[6] Composite volcanoes are sometimes referred to as a stratovolcanoes, although that term is not as popular in the professional geologic community because of the assumptions about the structure of the volcano that accompany the name (Davidson and De Silva 664).

Krakatoa developed from a modest eruption to the second deadliest in a matter of hours, and as with many eruptions, there was little that anyone could do.

The dramatic explosions of Krakatoa occurred between August 26-27 of 1883. The eruption lasted for "twenty hours and fifty-six minutes" (Winchester 210). Tom Simkin and Richard Fiske, in their work *Krakatau 1883*, construct a detailed chronology of Krakatoa's eruption using eyewitness reports and telegraphs. On the 25th of August there were a few isolated reports of explosions and ash falls (Simkin and Fiske 31). At 2:00 pm on the 26th a "tremendous explosion" was heard and the sky started to darken; by 3:00 pm the detonations were increasingly loud (Simkin and Fiske 32). The first major explosion occurred at 5:07 pm (Simkin and Fiske 33). For the next twelve hours explosions, earthquakes, and tsunamis battered the various settlements in and around the Sunda Strait. Four major explosions occurred on the 27th at 5:30 am, 6:44 am, 10:02 am, and 10:45 am. During that time the skies grew progressively blacker; ash, mud, and pumice rained down; and huge waves wiped out entire towns (Simkin and Fiske 35-40). Even the fragmentary chronology assembled by Simkin and Fiske suggests a terrifying catastrophe: a morning that grew as black as night, filled with falling mud and ash, punctuated by explosions that were louder than any cannon. Accounts detailing the horrors of those twenty hours were published quickly and then consumed by a shocked public. Records, like that of Captain W. J. Watson's, defined volcanic horror and what volcanoes were for the reading public.

The *Charles Bal*, sailing from Belfast to Hong Kong, was passing through the Sunda Strait as Krakatoa began to erupt. The captain, W. J. Watson, survived and wrote

of his experiences. He says that Krakatoa was initially surrounded by black clouds. Throughout the day of the 26th, the clouds grew and explosions could be heard on the ship. By nightfall, the eruption was in full swing, as Captain Watson says "The night was a fearful one: the blinding fall of sand and stones, the intense blackness above and around us, broken only by the incessant glare of varied kinds of lightning, and the continued explosive roars of Krakatoa, made our situation a truly awful one" (Watson 140). Between midnight and four in the morning "the same impenetrable darkness continued, while the roaring of Krakatoa less continuous, but more explosive in sound; the sky one second intensely black, the next a blaze of light" (Watson 140). On the 27th the situation looked no better, and in fact only became worse as the ship passed by towns that had been obliterated by tsunamis. Then according to Watson, at "11:15 there was a fearful explosion in the direction of Krakatoa" (Watson 140), although later investigators believe that Watson misremembered the time and it was in fact 10:15 (Simkin and Fiske 41). Watson says that this explosion caused massive waves and a "downpour of mud, sand, and I know not what" (Watson 141). By midnight on the 27th, the ship managed to get seventy-five miles away from Krakatoa, surviving where others did not. Captain Watson says of his experiences "Such darkness and such a time in general, few would conceive, and many, I dare say, would disbelieve" (Watson 141). Watson describes a horrifying series of hours filled with impenetrable darkness, huge explosions, cascades of hot rocks and mud, and blazes of light. The initial account seems to have been published in the *Liverpool Daily Post*, then subsequently republished in other outlets, like December 6th, 1883 edition of *Nature*, and *Littell's Living Age* in Boston. Like many of the survivors'

stories, Watson's story gets to the public through the media. Readers of these stories would see an infernal volcano, blotting out the sun, raining rock, and destroying lives. Watson's narrative reinforces an impression of the volcano as explosive and deadly. His first-hand experience of volcanism is terrifying, even apocalyptic. Readers' beliefs about volcanoes would be confirmed, especially by the multiple reports, stories, and tales about Krakatoa's apocalyptic eruption that easily made their way around the world thanks to new communication technologies.

The first reports from the area around Krakatoa are brief. *The Morning Post* reported on the 28th, based off a Reuter's telegram sent a day earlier, that "terrific detonations from the volcanic island of Krakatoa were heard last night and were audible as far as Soerakarta [Surakarta], showers of ashes falling as far as Cheribon [Cirebon]" ("Volcanic Eruptions in Java"). The report emphasizes the darkness that the towns were experiencing, the destruction of infrastructure, and rocks that had been hurled into the air from the explosion ("Volcanic Eruptions in Java"). Many of the news reports that day repeat the ideas from the Reuter's telegram: darkness and destruction. On the 29th, the news reports are largely the same, elaborating on a new telegram from Reuter's. The new telegram reports that various Indonesian towns were either covered in ash, mud, and pumice; plunged into darkness; or were swept away completely ("The Eruption of Krakatoa"). *The Pall Mall Gazette* claims that "Java is once more making good its right to contest with Japan the grim title of the 'Lid of Hell'" ("'The Lid of Hell'"). The article describes Krakatoa as an "infernal caldron" that is "boiling over" and that the volcanic eruption is a "terrible disaster" ("'The Lid of Hell'"). Interesting, the article also

references Tambora's eruption in 1815, mentioning that the two eruptions might be comparable. And the article notes the intense darkness that witnesses experienced ("'The Lid of Hell'"). More telegrams arrive claiming that sixteen volcanoes have appeared where there was one, that one thousand bodies have been recovered, that part of the land has become a desert, and that the population is "in despair" ("The Volcanic Eruption in Java"). The news reports continue through August until October, and then in December articles noting the brilliant sunsets begin to appear.

The idea of Krakatoa that the various newspapers and other media describe is understandably apocalyptic, with explosions, darkness, and a rain of destruction. The stories of survivors confirm such horrors. Krakatoa matches exactly the horrific expectations that mid-nineteenth century Britain had about volcanoes, having heard of the eruption of Vesuvius in 79 CE, and the subsequent eruptions of Vesuvius between 1824 and 1875 ("Vesuvius"). Krakatoa is the most familiar kind of volcanic eruption: a steep-sided mountain that explodes violently over a short period of time. For many people Krakatoa, like Vesuvius, is the classic volcanic eruption. All volcanoes seemed to act exactly like Krakatoa: a tall mountain that waits silently and erupts violently. Krakatoa had been silent for two hundred years: before 1883, it last erupted in 1684 ("Krakatau"). The slow, silent, explosive conception of volcanism dominated the western world. Understanding the scope and scale of volcanoes like Krakatoa was difficult. With little warning, the volcano would suddenly disrupt human life. The explosivity of volcanoes means that while most of the time they are slow, they can quickly shift. Most volcanic action is imperceptible, except for the spectacle, making volcanoes difficult to

comprehend. But, for the Western world, new kinds of volcanoes were discovered in the nineteenth century, ones that in many ways defied the classic conception, and yet were still as spectacular. These different volcanoes, like Kīlauea, allowed nineteenth-century British readers to move beyond the horrifying volcanism of Krakatoa and see more features of volcanoes, like their constructive power.

2. Kīlauea

Unlike the other volcanoes discussed thus far, the Hawaiian volcanoes are different. The volcanoes, such as the ones on the island of Hawai‘i, Mauna Loa, Mauna Kea, Kīlauea, Hualālai, and Kohala, are all shield volcanoes. The name, shield volcano, is evocative of the shape of the volcano: they look like a Greek warrior's shield placed on the ground. In contrast with a composite volcano, a shield volcano is not steep. They can reach impressive heights nevertheless: Mauna Loa is 13,680 feet tall, despite its gentle slopes. Frequent, liquid (low-viscosity) eruptions are how these shield volcanoes grow, slowly adding layer upon layer upon layer of rock (Walker 284). Kīlauea has been erupting constantly since 1983 ("Kilauea") and "Mauna Loa and Kilauea are the most productive volcanoes on Earth, having a combined lava output of about 8 km^3 per century" (Walker 284). The Hawaiian Islands are the most famous shield volcanoes, although there are others throughout the world. Compared to composite volcanoes, though, shield volcanoes are rarer. The Hawaiian volcanoes are further unique because of the cause of their volcanism, a geologic phenomenon referred to as a hotspot.

The other volcanoes, like those in the south of Italy or in Indonesia, are primarily caused by the subduction of one tectonic plate under another. The Hawaiian volcanoes are the result of a hotspot, a place of usually high volcanic activity potentially unrelated to the movement of tectonic plates against each other. At the moment, the geological debate around what exactly causes a hotspot is still undecided and even the term "hotspot" is disputed (Foulger 267). One theory, the plume theory, says that there are superheated plumes of rock that come from the core of the earth, rise through the mantle, the asthenosphere and lithosphere, and erupt onto the earth (Foulger 8). Further, plume theory holds that these hotspots are the engines of plate tectonics (Foulger 8). The other theory, the plate hypothesis, says that hotspots are caused by areas where the lithosphere, which includes the crust and the upper part of the mantle, is weaker and allows melted rock from the asthenosphere to rise up, pool, and erupt (Foulger 27). Also, plate theory assumes that the mechanism of plate tectonics is in the lithosphere, not the core (Foulger 27). The importance for this discussion is that while Hawaiian volcanoes are volcanoes, they are also remarkably different in mechanics and structure which is why they were so important to nineteenth-century understandings of volcanoes.

Before the western explanations for Hawaiian volcanism, the Hawaiians had their own explanation: the god Pele. The name of the Hawaiian volcano god is perhaps the best known of all the deities in the Hawaiian religion. Unfortunately, most of the introductions and histories about Pele were written by American scholars, who were part of the "reframing of the mo‘olelo[7] to fit a Western paradigm that reinforced the overall colonial

[7] "narrative, story, history" (ho‘omanawanui 259).

project" (hoʻomanawanui xxxiv). kuʻualoha hoʻomanawanui attempts to recover the Hawaiian literary tradition around Pele in *Voices of Fire.* She notes that Pele was "born in fire millennia ago" (hoʻomanawanui 4) just like the islands. And like the Hawaiians themselves, Pele is not native to the islands at first: "Pele is a malihini (foreigner, newcomer) who voyaged, like countless generations of Kanaka[8] […] from the ancient homeland to Hawaiʻi" (hoʻomanawanui 25). After travelling across the Pacific, with the other gods and the ancient Hawaiians, Pele and her companions arrive on the islands. She goes from Kauaʻi to Hawaiʻi searching for a home, creating "geographic formations as she digs in the earth with her ʻōʻō (digging stick) Pāoa searching for a home" (hoʻomanawanui 26). Eventually, Pele finds and settles in the Halemaʻumaʻu crater on Kīlauea. In Hawaiian tradition, Pele is not an aloof or antagonistic volcano god that rains fire upon the people of the islands. Instead she is a dynamic individual with passions and emotions that inform an important part of Hawaiian knowledge, beliefs, and values, especially as she both destroys and yet builds land. Pele's veneration by the Hawaiians shows how volcanoes might be considered otherwise: not as purely destructive forces, but as both creative and destructive.

The ability of the Hawaiians to worship as they pleased waned with the arrival of Captain Cook in 1778. After Cook, foreign visitors to Hawaiʻi increased rapidly so that before the dawn of the nineteenth century Honolulu was already "becoming a foreigner's town" (Tabrath 26). In the nineteenth century, scientific knowledge about Hawaiian volcanism was fairly well developed thanks to a host of expeditions, visiting geologists,

[8] "indigenous Hawaiian" (hoʻomanawanui 258).

and resident missionaries. Two of the most important geologists who visited Hawai‘i were the Americans James Dwight Dana (1813-1895) and Clarence E. Dutton (1841-1912). James Dwight Dana was one of the first geologists to investigate the Hawaiian volcanoes. He was part of the United States Exploring Expedition, which surveyed parts of the lands around the United States and throughout the Pacific between 1838 and 1842 for scientific, economic, and colonial reasons (Joyce 12). Dana's report focused on the geology of the Pacific Rim.

Hawai‘i takes up about 129 pages of a 700 page report, almost twenty percent of a report that also covers much of the western and southeastern Pacific, suggesting that Hawai‘i was especially interesting to Dana, which he confirms (Dana 155). Dana's rationale is that in Hawai‘i a geologist could see both the creation of new land, through volcanoes, and the erosion of the same land, through waves and rains. That being said, Dana does focus a great deal on the creation of new land, especially as the mechanisms of volcanoes were still not well understood. Hawai‘i has particular advantages when it comes to the study of volcanism, as Dana says a geologist "may descend to the boiling pit, and witness the operations in the vast laboratory, with the same deliberation as he would examine the crucible in a chemist's furnace" (Dana 155). One of the important features that Dana identifies is the slow nature of the Hawaiian volcanoes: they allow for easy study. Krakatoa's eruptions would be difficult to live through let alone study, unlike Kīlauea's. Dana himself got the opportunity to descend into the boiling pits when he visited in 1840. Despite the scientific nature of his work, Dana's narrative matches a large number of travelogues as he goes from disappointment to amazement.

Dana's report on Kīlauea shows the way that Victorians generally conceptualized volcanoes. Dana himself notes that "the idea of a volcano is so generally connected with the figured of a cone, that the mind at once conceives of a lofty sugar-loaf ejecting fire, red-hot stones, and flowing lava" (Dana 168). The sugar-loaf, a conical mass of sweet carbohydrates, is what was expected of volcanoes by Victorians, like Krakatoa. Composite volcanoes are one of the most common types of volcanoes on the planet, but that does present a problem for comprehension of other types of volcanism, such as shield volcanoes like Kīlauea or calderas like Yellowstone. Victorian explorers, scientists, and tourists were discovering not all volcanoes were the same; understanding these other kinds of volcanoes was key to grasping the mechanisms of the earth. Nevertheless, the expectation for a volcano was an explosive, conical mountain therefore it is unsurprising that Dana was disappointed. When he gazed over the mouth of Kīlauea, the view was lacking the features he expected: "the eye naturally ranged over the whole area for something like volcanic action, as it is usually described. But all was singularly quiet" (Dana 171). Dana's reaction is not unique; many people reach the summit of Kīlauea expecting what the missionary, William Ellis, describes as "rolling to and fro its fiery surge and flaming billows" (W. Ellis 131). Dana even cites Ellis's description to register his surprise at Kīlauea's appearance (Dana 171). Even though volcanoes are grand, sublime, and terrifying, they can also be disappointing. Dana assumed that he was going to see a steep mountain of rock, exploding violently. A professional geologist's disappointment with Kīlauea's structure is an important trend that will be repeated by

subsequent visitors to the volcano, as the disappointment allows visitors the aperture to begin to see deep time.

Dana knows that his description will be unsatisfying, and says that his observations were recorded faithfully thus "We are not responsible for any disappointment they may create" (Dana 173). Merely being in the volcano or thinking about it extensively seems to start to change Dana's mind, as he speculates on what an eruption might look like. He imagines what Kīlauea would be like in action, with lava flowing everywhere, fountains shooting molten rock into the sky, and subterranean thunder punctuating the scene; Dana reflects that "Such a scene over an area seven and a half miles in circuit, must be terrific beyond description" (Dana 173). He even comes to see Kīlauea's quiescence as more sublime than that of a composite volcano: "this repose is, perhaps, more fearfully sublime than the fitful heavings of a Vesuvius" (Dana 176). Dana's fascination with Kīlauea is apparent in the almost forty pages devoted to it, about thirty percent of the chapter on Hawai'i (Dana 171-211). Of all the features on the islands, Kīlauea is given a significant portion of the focus. Despite Dana's expectations, the volcano, its violence and expanse through time begin to dawn on the American geologist.

Towards end his report, Dana speculates on the origins of the islands, which he believes is a series of ruptures in the crust along two to three lines between Kaua'i and Hawai'i (Dana 280). These tears in the crust erupted lava until they ran out: "From Kauai to Mount Loa all may thus have simultaneously commenced their ejections, and have continued in operation during the same epoch till one after another became extinct"

(Dana 280). Dana's theory is that Hawai'i sits over a type of rift zone that erupted enough lava to build from the ocean floor all the way to the heights of Mauna Loa. While these volcanoes erupt frequently, they still would need an immense span of time to build to such heights. The volcanoes provide Dana, once he stops being disappointed, the chance to see the edges of deep time in the construction of the islands. Kīlauea and Hawai'i are evidence that allow Dana to begin to develop global geologic theories. Dana also takes the time to connect the Hawaiian volcanoes with ongoing geologic debates, such as disputing the idea that volcanoes are "safety valves" for earthquakes, saying that that volcanoes are not valves and that "volcanoes are in fact indexes of danger, and the absence of them is the best security" (Dana 222). James Natland argues that it was thanks to these expeditions that Dana began to develop theories of planetary volcanology (Natland 313) using Hawai'i as an important point of synthesis for geology. Dana's report is one of the first, most detailed geologic investigations of the islands and their volcanism.

Clarence E. Dutton visited Hawai'i later under the auspices of the newly formed US Geological Survey. Dutton traveled to Hawai'i in 1882 and reported his findings to the USGS in "Hawaiian Volcanoes" a section of the longer *Report of the Director of the United States Geological Survey*, which was presented by John Wesley Powell, the director of the USGS, to the Secretary of the Interior, Henry M. Teller, in 1883. Dana and Dutton both helped building the scientific understanding of the Hawaiian volcanoes through their field work and researches. Dutton's work is especially important, as it came after fifty years of development in both geology and volcanology.

In 1883, the study of volcanoes had advanced from Lyell's claims in *The Principles of Geology*, but there were still many features of volcanoes that were unknown to scientists. The debate around whether volcanoes were caused by chemical reactions or mechanical forces was still ongoing (Sigurdsson 169). Many of the advances in volcanology between the 1830s and the 1880s focused on the composition of magma and its physical properties. Around the middle of the nineteenth century melting through a decrease in pressure was starting to be understood, thanks to William Hopkins, John Judd, and Clarence King (Sigurdsson 197-98). But there were still large gaps which could only be filled by increasingly advanced technologies. Volcanology was understanding its subject better and better at a micro-level, but still was missing many of the macro-level theories that are recognizable today. Large scale collect of data was still necessary to show the scope of volcanic action, such as a series of surveys of the ocean floor around Hawai‘i.

Thanks to those surveys, Dutton is aware of the lines of submarine mountains that headed north west from Kaua‘i. He speculates that "there is reason to believe that this same submarine chain continues in great force many hundreds of miles to the west-northwestward of Kauai" (Dutton 83). Dutton was no doubt working from Dana's identification of the linear chains of volcanic islands in the Pacific (Natland 330), but his hypothesizing is much grander. Dutton is speculating about the existence of the underwater volcano chain known as Hawaiian–Emperor seamount chain which is 3,600 miles (5,800 kilometers) long, stretching down from the Aleutian Trench near Alaska to the newest Hawai‘i volcano, Lō‘ihi, thirty-five miles southeast of the island of Hawai‘i.

For Dutton, Hawai‘i is a valuable space for understanding the mechanisms of the earth because of both the active and extinct volcanoes. He notes in his report that “the supreme attractions which these islands present to the geologists are the great volcanoes of the island of Hawaii” (Dutton 92). Dutton is only writing for geologists, but the idea is notable, especially once more and more tourists also begin scaling the various Hawaiian volcanoes to look into the earth. The “Hawaiian Volcanoes” report by Dutton explores these volcanoes from a geologist’s perspective, recording their features empirically but missing opportunities to consider the volcanoes aesthetically as Lyell did.

Dutton provides more than a catalogue of the features in his report to the United States Geological Survey (USGS), he also provides a narrative of his expedition. The second chapter, where the narrative begins, also is about Dutton’s trip to Kīlauea. He starts his journey in Waiohinu, to the southwest of Kīlauea, unlike many other travelers who start in Hilo. Dutton’s journey takes him through pāhoehoe and ‘a‘ā fields (Dutton 95-96) which he dutifully reports upon. Not only does Dutton include descriptions of the objects that he sees, he includes photographs. The photographs look like a huge white sky over a huge black field with very little texture. While these photos are difficult to read, the inclusion of these images no doubt helped members of the USGS better comprehend the kinds of lava that Dutton was describing. Dutton also says that traveling across the lava fields is “very memorable” and then goes on to provide a complicated description of the emotional experience of the lava field: “It conveys a sense of grandeur, solemnity, desolation, bit above all, monotony. Very impressive, too, is the sense of magnitude and power which it produces” (Dutton 102). The photographs in the report reinforce Dutton’s

description: stark, endless field of ebony rock, which was at one point intensely hot and very liquid. The words that Dutton chooses reflect the mixed emotions that lava can evoke, as both a destructive force, a complex part of the earth's dynamic nature, and yet the sameness that is frequent with new lava fields. Dutton expresses some of the same emotions, respect, awe, terror, and boredom that other travelers to Hawai‘i would connect with the volcanoes. The digression into the feeling of being on a lava field is important too because it is one of the few spaces that Dutton does express his emotions when it comes to the environment around him, otherwise ceding the opportunity to use emotion to help describe the differences between Hawaiian volcanoes and composite volcanoes.

As Dutton travels up Kīlauea, he claims that he gains more familiarly with the volcano. Dutton's reaction to Kīlauea is incredibly circumspect. He calls the sight "a memorable spot" and later notes that "desolation and horror reign supreme" (Dutton 104). These two are the only emotive descriptions that Dutton gives to the volcano; much of the rest of the page is dedicated to defining the dimensions of Kīlauea, noting its interior, and its surroundings. His goal, of course, is to report the features not to relate aesthetic impressions. Dutton's reservation and objective reporting continues throughout the chapter: he takes a very standard trip around and through the volcano, even venturing up to the Halema‘uma‘u pit crater to see the lava lake. But during that time he just records facts and data, no experiences, beyond mentioning that he is afraid for his life at one point (Dutton 109). Instead, Dutton attempts to detail the phenomena around him in as accurate diction as possible. He suggests calling the opening of Kīlauea a caldera, instead of a crater, given that they are formed in different ways (Dutton 105). He gives a

very descriptive account of the lava lake's cycling of lava where the lake will cool and blacken until new material falls in and breaks the crust which will cause the lake to resume a liquid appearance (Dutton 106-07). Dutton even constructs a history of Kīlauea by using Hawaiian stories about Keōua Kūʻahuʻula and his army, a third of which perished in an eruption of the volcano (Dutton 112), the missionary William Ellis (Dutton 113) and the United States Exploring Expedition (Dutton 115). As with other volcanological works, primary sources are key to establishing the nature of Kīlauea, but not all records are equal thanks to the overwhelming nature of the volcano.

Dutton also draws on the records of the travelers at a nearby hotel called the Volcano House. The hotel kept a log book, referred to as the "Volcano Book" or "Volcano Diary," where tourists could write down their impressions of Kīlauea. Dutton uses that log to further his history. At first he believes that the volcano has diminished in energy, given the spectacular descriptions he found in the log. After a more careful reading, though, Dutton says,

> It is evident that the writers were profoundly impressed with the sublime spectacle, and their deepest emotions were stirred. It is natural under such circumstances that their writings should portray the intensity of their feelings. It is not to be suspected for a moment that they intended to exaggerate, but under the spur of intense enthusiasm they aimed rather to express what they felt than to give a rigorous and exact description in cool, formal language. (Dutton 118)

Dutton's criticism makes sense. He wants is an objective recording of the volcano. Emotive language was judged to be subjective, biased. Dutton's acknowledgement of the sublime nature of the volcano and that an emotional reaction is "natural" is intriguing, because it would seem to mean that Dutton himself has those feelings or emotional

reactions to the volcano, yet suppressed them. Certainly, with the lava fields, Dutton felt as though he could provide a more emotive description. Yet, as noted, the chapter on Kīlauea is silent in that regard. Instead Dutton is quite cool and formal, as he says recorders should be. For Dutton's purposes, he needs to be more objective and less subjective to measuring the volcanic energy of Kīlauea. Whereas the static lava fields allowed him the chance to be subjective. That being said, Dutton seems to be restraining himself, especially given his response to the lava fields and his brief comments on Kīlauea; he too seems to be struck by Kīlauea, despite his efforts seeking objectivity. Dutton's reaction is a contrast to many of the other reactions to Kīlauea: cool in the face of volcanic heat.

Dutton travels all over the rest of the islands, climbing up Mauna Loa and Mauna Kea and going to Maui and O'ahu. The report is very thorough, but it also throws some of Dutton's reactions to Kīlauea into a different light. When Dutton beholds the temporarily quiet summit caldera of Moku'āweoweo at the top of Mauna Loa, is he much more emotionally descriptive than when he saw Kīlauea. He describes the caldera in terms of the impression it made on his mind first, not its dimensions, although he gets to the dimensions too (Dutton 139-40). Dutton says that viewing Moku'āweoweo made him feel a strong sense of isolation "the strongest feeling impressed upon the mind was that of superlative calm, solitude and desolation" (Dutton 139). The caldera on Mauna Loa causes Dutton to reflect on the sublime, suggesting a connection between deep time and aesthetic feeling. Given his reaction to Moku'āweoweo, it does seem that Dutton was restraining himself when he visited Kīlauea, perhaps because he felt that the descriptions

of Kīlauea were too becoming too emotional, given his reaction to the Volcano Book. But Dutton is giving up an opportunity to help show how shield volcanoes work through geologic time, in contrast to composite ones. The growing professionalization of geology moved Dutton towards observation and theorizing, losing the chance to connect geologic time with human time.

Dutton details most of the theories related to the causes of volcanoes. He outlines the theory where water seeps into rocks, then "when the eater has penetrated to depths where the temperature is about 772°F., or 412°C., it is vaporized, no matter how great the pressure may be" (Dutton 186). The vapor infiltrates the lava, reduces its temperature, which then brings it back into thermal equilibrium, and when the equilibrium "is restored the water-charge lava is in an elastic explosive condition" (Dutton 186) and thus travels up to the surface and erupts. Dutton's theory in some way is similar to current thought in regards to volcanoes along subduction zones, though it does not explain the Hawaiian volcanoes. Dutton also details his thoughts on the chemical theory of volcanoes (Dutton 192), theories that volcanic energy is caused by thermal decay (Dutton 193), even decompression melting (Dutton 194) which is widely accepted in the twenty-first century as an important volcanic mechanism. Dutton rejects these theories because they are require other features, and concludes that Mauna Loa has a lower specific gravity, i.e. lower density, than surrounding material which buoys it up from the ocean floor (Dutton 196) and that the lava lakes at the summits of Mauna Loa and Kīlauea are connected to "columns of liquid lava extending to depths in the earth which are probably very great" (Dutton 196). In regards to density, Dutton is not correct for the island particularly, but

the connection to a deep reservoir of lava resembles plume theory in a nascent fashion. Despite being about one hundred years removed from the accepted explanation of the Hawaiian volcanoes, Dutton has some of the pieces of that explanation already. Dutton's report is one of the most scientifically advanced texts on Kīlauea and Hawaiian volcanism generally for the time, but it has too narrow an audience. Unlike texts like Lyell's which was available in a popular format, Dutton's was a government document. Geology had seceded some of its explanatory power with its narrowing focus. Other writers, like Constance Gordon-Cumming, would fill the gap, describing the details of the Hawaiian volcanoes to an audience enthusiastic for volcanic scenes.

3. Constance Frederica Gordon-Cumming

Constance Frederica Gordon-Cumming was born in 1837 in Scotland, to Sir William Gordon-Cumming and Elizabeth Maria Cumming of the Gordon-Cumming Baronetcy, a noble family with lineage "traced back to Charlemagne" ("Obituary: Mss Gordon-Cumming"). Gordon-Cumming was the twelfth of fourteen siblings (Robinson 94). She grew up "amid beautiful and happy surroundings" on the Gordon-Cumming estate of Altyre, in Morayshire, and was educated in London ("Obituary: Mss Gordon-Cumming"). According to Robinson, "Gordon Cumming was the perfect candidate for a life of leisurely travel" (Robinson 94) because of her family's title and wealth, and her own lack of responsibilities towards either work or succession. She began travelling after her parents had died and her brother, Sir Alexander Penrose Gordon-Cumming, became

the third Baronet. She went to India via Egypt in 1868 (Robinson 94). Subsequently, she travelled to Ceylon [Sri Lanka], then to Australia, Fiji, Tahiti, and New Zealand. Then Gordon-Cumming travelled to California, Japan, China, and Hawai‘i, and finally back to Scotland.

The wide range of Gordon-Cumming's travels are impressive. And Gordon-Cumming wrote extensively about her travels in books which were published between 1876 and 1892. Books like *From the Hebrides to the Himalayas* (1876), *At Home in Fiji* (1881), *A Lady's Cruise in a French Man-of-War* (1882), and *Granite Crags* (1884), along with many others that covered her journeys throughout the world. Contemporary critics of Gordon-Cumming were "probably flabbergasted by the sheer bulk of her work, likened Miss Gordon Cumming to Isabella Bird and dubbed her one of the greatest of what *Vanity Fair* called 'our wonderful lady travellers'" (Robinson 94). Gordon-Cumming was one of the Victorian travel writers who helped readers see new and exotic parts of the world. Constance Frederica Gordon-Cumming died in 1924 at the age of eighty-seven in Scotland. She was remembered as "a keen observer, interested in many of the aspects of the regions she traversed […] so that her narratives, full of brightness and humour and human sympathy, were for the time substantial contributions to knowledge" ("Obituary: Mss Gordon-Cumming"). As *The Times* obituary rightly points out, Gordon-Cumming helped her readers understand other peoples and learn about the world. Although Gordon-Cumming's modern "reputation as a traveller has sunk somewhat" (Baigent), she was successful in her time thank to her ability to be both a proper Victorian woman and also an undaunted explorer.

Gordon-Cumming's credibility as a writer and traveler, was reinforced by the ways that she moved between femininity and masculinity. She was a modest Victorian woman who was simultaneously pushing at the boundaries of what women should do. Maintaining the proper decorum was very important to her. On her way to Kīlauea, Gordon-Cumming happens to lunch with a few Hawaiians, who spoke little English but were able to say "My God!" which causes Gordon-Cumming to comment "It certainly is unfortunate that the stray fragments of English acquired from passing foreigners should so often be suggestive of anything but reverence" (*Fire Fountains* 1: 131). Or her annoyance that the "Volcano Diary" has a few entries that are vulgar and profane (*Fire Fountains* 1: 147). Despite maintaining the necessary decorum, Gordon-Cumming still notes that she is just as capable as anyone else: "You know I can 'rough it' as well as most folk when there is any occasion" (*Fire Fountains* 1: 11). When riding up to Kīlauea, she is willing to ride her mule "*à califourchon*" or astride, rather than side-saddle, because she is tired (*Fire Fountains* 1: 141). Lila Harper points out in *Solitary Travelers,* that riding sidesaddle "was dangerous when used in rough terrain" (Harper 153) but that riding astride could potentially lose a woman writer her credibility (Harper 157-58). That Gordon-Cumming was willing to admit her change of position is interesting, yet she positions the situation in the context of utility. Her riding habits are an excellent encapsulation of her personality: Gordon-Cumming maintains traditional roles up to the point that it might prevent her from seeing the parts of the world that she wants. Her willingness to bend the rules for new experiences is also what makes Gordon-Cumming a

capable scientific observer, even though she does not explicitly tout any scientific interest.

Geology seems to be of some fascination to Gordon-Cumming. Her family's estate frequently entertained scientists like "Louis Agassiz, Hugh Miller, and Sir Roderick Murchison" (Feeser 91) and was near to a quarry where fossils were being discovered. Throughout the travelogue Gordon-Cumming makes references to geologic theories and uses geologic terminology. Early on in *Fire Fountains*, as she is approaching O'ahu, Gordon-Cumming notes that "there are distinct strata of black and bright red, purple and brown lava, all thrown about in the most eccentric masses" (Fire Fountains 1: 14). The use of the word "strata" shows some geologic knowledge, as the term can refer to the order in which rocks are deposited. Beyond the use of that individual word throughout the initial description of the island, Gordon-Cumming also uses the words "basalt," "olivine," and "porphyritic lava" and describes the erosion of Hawaiian rocks. Gordon-Cumming never says specifically that geology is an interest of hers, nor does she frame her travelogue as solely a discussion of geology. But much of the *Fire Fountains* is focused on geologic subjects.

Gordon-Cumming shows an interest in geology, especially as it relates to volcanism. When visiting with the various British colonists on the islands, she says that "To me it is a never-failing delight to lead the conversation round to the olden days, or to the wonders of lava flows and earthquakes and tidal waves, into which subjects it always seems to glide easily, and concerning which I hear something new and marvellous from each speaker" (*Fire Fountains* 1: 118). There are any number of interesting Hawaiian

topics that Gordon-Cumming could have focused on, but instead she turns the conversation towards the geologic activity of the island, and the colonists' experiences of those activities. Or, later when she is close to one of the Hawaiian volcanoes, Gordon-Cumming gathers up igneous specimens: "I added a considerable collection of specimens; for (though not generally given to annexing such matter) this newly created lava, fresh from the great internal foundries, and of such very varied quality, has a peculiar interest of its own" (*Fire Fountains* 1: 176). Hawai'i is not the first place that Gordon-Cumming has collected rock samples from: she admits to collecting one from Mount Fuji too. The fact that she adds parenthetically that she does not normally gather specimens, but decides to make exceptions for volcanic rocks from Kīlauea and Mount Fuji helps show that volcanoes were particularly fascinating to Gordon-Cumming, and that geology was more than a passing fancy.

Fire Fountains: The Kingdom of Hawaii its Volcanoes, and The History of its Missions was published in 1883, a fortunate coincidence for Gordon-Cumming, given how popular volcano books would become later in the year. The travelogue very much foregrounds volcanoes. Obviously, the title of the work the *Fire Fountains* is focused on volcanic action, and makes volcanic action the central feature of the islands. The subtitle continues this theme with *The Kingdom of Hawaii its Volcanoes* noting that the book will be about volcanoes, again. Similarly, in the very first sentence of the entire work, Gordon-Cumming says "[William] Ellis and other enterprising travellers sent home such marvellous accounts of volcanic action—of fountains of living fire and flaming billows—as seemed to their hearers like fairy-tales" (*Fire Fountains* 1: 1). Gordon-Cumming

places volcanoes at the front of her work: the reason she is going to Hawai‘i is to see these fabled fire-fountains, most of the first volume is dedicated to travelling to and viewing volcanoes, a popular topic at the time. Diana Looser notes that by Gordon-Cumming’s time Kīlauea was both a literary trope and a tourist destination (Looser 371-72). Despite that or perhaps because of it Gordon-Cumming’s audience wants to see scenes of volcanoes, both in text and in illustrations. The Hawaiian volcanoes were fascinating as they provided apertures into the inner workings of the earth.

The first sight that Constance Gordon-Cumming gets of Hawai‘i is of the volcanoes. She is not impressed though: “I beheld only a pile of shapeless hills, 8000 feet high, but of the most arid, repellent appearance, notwithstanding that I saw them glorified by a flood of mellow gold, just as the sun rose” (*Fire Fountains* 1: 2). The unimpressiveness and/or ugliness of the islands would become a theme for Gordon-Cumming, although she would end up revising her opinion. Gordon-Cumming continues, introducing Kaua‘i in an interesting fashion, immediately honing in on the geologic construction of the island: “Kauai, the northernmost island, which is supposed also to be the oldest of the group (so geologists infer from the degradation of its purely volcanic hills and cones and the depth of alluvial deposit in the many craters)” (*Fire Fountains* 1: 2). Not only does Gordon-Cumming display a knowledge of geology, she also demonstrates geological thinking. Clarence Dutton in his report, makes the same observation in regards to Kaua‘i and its age (Dutton 84) so Gordon-Cumming’s thoughts mirror the dominant geological theory. But aesthetics are also part of Gordon-Cumming’s purview in the travelogue, and at least with Kaua‘i she is not thrilled. Gordon-Cumming

eventually revises her opinion as she gets to see more of the islands up-close, even changing her opinions of the shapeless, arid hills.

Chapter seven, eight, and nine of the *Fire Fountains* contain Gordon-Cumming's letters as she ascends Kīlauea and stays at the Volcano House on the edge of the caldera. She starts out from Hilo early, piling her "poor beast" up with her side-saddle, painting supplies, umbrella, and herself, which Gordon-Cumming remarks "made up a pretty considerable weight to pile on to any patient animal" (*Fire Fountains* 1: 126). Gordon-Cumming again takes the opportunity to make a comment about the construction of the islands, saying that the islands had grown through the deposition of "successive flows of exceedingly fluid lava" (*Fire Fountains* 1: 126). As noted earlier, the lava that shield volcanoes like Kīlauea erupt is known for low viscosity, and thus they do build in the manner that Gordon-Cumming suggests. The journey takes Gordon-Cumming through the forests on the eastern side of Hawai'i, where she is surprised by the beauty of the islands, despite its initially "barren" appearance (*Fire Fountains* 1: 127). Gordon-Cumming's previous experiences were in the South Pacific, Tahiti and Fiji. These islands are more verdant and match Gordon-Cumming's environmental expectations. Beyond the forest, Gordon-Cumming's trail takes her over lava fields. Gordon-Cumming uses the Hawaiian names for the lavas, pāhoehoe and 'a'ā. These are the same terms that Clarence Dutton would use in his report to the director of United States Geological Survey (Dutton 95) and the terms that have become accepted professional terms for referring to certain lava flows (Kilburn 960). Gordon-Cumming's efforts, acknowledging the construction of the volcanoes and their exotic lavas, help her audience see that Hawaiian volcanoes are

categorically different than Vesuvius. Before her readers even see the volcanoes themselves, she establishes that the volcanoes are unlike any volcano they have imagined before.

After the initial descriptions of the lava fields, Gordon-Cumming devotes a little space to her "poor beast," the horse that is carrying her over the alternatively jagged and smooth lava. She says, "I have named my beast 'Caution,' because of his large development of that most excellent quality, which I greatly esteem when on difficult ground" (*Fire Fountains* 1: 134). Gordon-Cumming is lucky to have such a surefooted horse, because the potential for Caution to lose its footing and throw or topple over on Gordon-Cumming is quite high (*Fire Fountains* 1: 138). Along the way to Kīlauea, Gordon-Cumming has lunch with a group of Hawaiians, travels over the lavascape in the hot sun, avoids treacherous crevasses in the lava, and switches to riding Caution astride (*Fire Fountains* 1: 136-141). She eventually arrives at the Volcano House in the evening. The night was quite cold, but filled with steam rising up from cracks in the earth; Gordon-Cumming calls the scene "very eerie" (*Fire Fountains* 1: 141). Interestingly, especially given her later interactions with the volcanoes, Gordon-Cumming is not burning to the see Kīlauea straightaway, instead "not even the fiery glow reflected on the clouds could keep me long away from the good hot coffee and substantial supper" (*Fire Fountains* 1: 141). Given the tiring nature of her travels, it is no surprise Gordon-Cumming wanted to rest first. As she tells the reader on the next page, though, she had been dreaming of seeing the volcano for some time.

The next day, Gordon-Cumming wakes up early, and finally gets to see the volcano which she had been waiting so long to. Upon experiencing Kīlauea for the first time that day, after her long and difficult trip, Constance Gordon-Cumming has this reaction:

> Rested and refreshed, I was up betimes, to look with unwearied eyes upon this strange sight, of which I have been dreaming for years. Now I have spent four - and - twenty hours in its very presence, and . . . Well, I don't quite know how to put it. . . . The fact of the matter is, . . . I'm afraid I am rather disappointed. I suppose I expected too much. My mind was full of 'sportive fire fountains' and 'awful detonations,' and all that sort of thing; but I was utterly unprepared for the dull hideousness of the actual scene. I have never seen a sketch or a photograph which gave me the faintest idea of what this place really is; and now . . . Well I suppose I shall learn to understand it in a day or two. (*Fire Fountains* 1: 142)

In the original printing of the book, the ellipses in the above section are very large: almost a full inch on the page. The lack of spectacle is so great that Gordon-Cumming feels the need to visually illustrate just how shocked she is by *not* using words but just blank space. Reading the passage, Gordon-Cumming's disappointment is palpable. Her reaction is not surprising either: volcanoes are supposed to be evocative, explosive, violent, and bright, like Krakatoa. She had been told that Kīlauea was erupting, as another set of travelers had "just returned from the Volcano, where they say the Lake of Fire is in splendid action, surpassing all their expectations" (*Fire Fountains* 1: 75). And, as noted above, because of the nature of the Hawaiian volcanoes, they are frequently eruptive. The spectacle of volcanoes is important to Gordon-Cumming, just as much as the spectacle is important today. The Hawai'i Volcanoes National Park, which includes Kīlauea, on its homepage says "Experience the Heartbeat of a Volcanic Landscape" ("Park Home"). Even the National Park service suggests that volcanoes, Kīlauea in particular, and their

action, their heartbeat, are the main attraction of the park. From at least the Victorian period until the early twenty-first century, the expectation is that volcanoes are spectacular.

The section on Kīlauea does not even start with Gordon-Cumming's description of the volcano. Instead she arrives at the Volcano House, rests, and then starts with the passage quoted above. Readers do not even get to hear about the volcano before they experience Gordon-Cumming's disappointment. Placing the feelings first, though, is important for the reader, because when they go to read the descriptions that Gordon-Cumming provides the situation can be properly inflected. The disconnect that Gordon-Cumming feels is one of time scale. She says "So far, I must candidly confess, that for scenic effect these *constructive* fires cannot hold a candle to an ordinarily *destructive* one" (*Fire Fountains* 1: 142). Even though Kīlauea would become one of the most active volcanoes in the world, and even though it was quite active when Gordon-Cumming was viewing it, the time frame was still too long. Destructive volcanoes seemingly erupt violently at one brief moment. Krakatoa erupted over the course of a few hours. During that time it generated both spectacle and catastrophe: massive explosions, an eclipse of the sun, destructive waves, and a glut of red hot rock. Kīlauea merely glowed and vented some steam. The shield volcano was not fast enough to grab Gordon-Cumming's attention; it was spread across too much time. The importance of understanding the way that human beings perceive time in the relation to their environment cannot be over stated. Even catastrophic events like Krakatoa or Vesuvius are compressed down into

minutes. It is no wonder that Gordon-Cumming was quite frustrated when she saw Kīlauea at first.

The first description that Gordon-Cumming gives of the volcano is: "Here, one glowing cloud rising from the fire-lake in the central crater, and a broken line of irregular fire-dots, like red-hot cinders, which mark the course of a lava-flow in the outer crater, are the only indications I have as yet seen of the mighty power working beneath us" (*Fire Fountains* 1: 143). Even though rocks are often thought of as solids, they can become liquid with enough heat. Of course, the difference in heat required to make basalt liquid versus water is quite extreme, about 474 °C on the low end as water is generally liquid at 1 °C and lava can be liquid at 475 °C (Kilburn 960). Therefore it is no surprise that the surfaces of lava lakes can be black and cooled. Gordon-Cumming's description focuses on the glowing remains of a previous eruption. Her frustration centers on the fact that the mighty power working beneath her is not more visible. Gordon-Cumming's disappointment is just beginning. Her failed and then fulfilled expectations with Kīlauea demonstrate how challenging aligning human perceptions with volcanic process is. Here, as in many cases, time is the limiting factor. Gordon-Cumming is just a few days too late to see the volcano she wants. Her description is accurate, if it is not quite exciting to her. Importantly, though, Gordon-Cumming also recognizes the constructive nature of the volcano with her reference to "mighty power working beneath us" but wishes that the mighty power were just a bit more spectacular.

As noted before, Gordon-Cumming is well read; she understands the geologic construction that is occurring on Hawai‘i. Later on, while discussing Mauna Loa in

contrast with Kīlauea, she notes that "For thus the whole of this great island has been built up. Flow upon flow, layer upon layer, ever deepening, coarser or smoother, according to whether the furnace within has been 'seven times heated' or whether the fires are moderate" (*Fire Fountains* 1: 145). On a purely conceptual level Gordon-Cumming understands what is occurring beneath her feet and around her. She appreciates the situation she is in saying that Kīlauea specifically, and Hawai'i generally, are "probably the only spot on earth where Dame Nature admits mortals to be actual eyewitnesses of her labours in her vast foundries and smelting-works" (*Fire Fountains* 1: 146). But the volcanoes do not match Gordon-Cumming's expectations. She justifies her experience by saying that due to the dynamic nature of the volcano there is no way to predict what it will look like. She describes the Halema'uma'u crater, translating its name as "House of Everlasting Burning," and continues on to say that the name is apt because it is "constantly varying, so that no two people ever see it quite alike; and while some describe it as a lake of living fire, three miles in circumference, others, coming a month later, find a cluster of high crags thrown up and almost choking the lake" (*Fire Fountains* 1: 146). Regardless of her rationalization, Gordon-Cumming is still disappointed. Her unhappiness with Kīlauea causes Gordon-Cumming to consider the mediocre nature of the other volcanoes in the area.

Gordon-Cumming's experience of Kīlauea is similar to her assumptions about Mauna Loa. Earlier in her travels, Gordon-Cumming commented on Mauna Loa, saying that "I really am sorry to be obliged to confess it, but Mauna Loa is unquestionably a very ugly mountain" (*Fire Fountains* 1: 121). Gordon-Cumming does note the size of Mauna

Loa makes it worthy of respect; the volcano is 13,680 feet in elevation starting at sea level, or it is 56,000 feet in elevation measuring from the sea floor up ("Mauna Loa"). Despite the fact that Mauna Loa is quite tall, Gordon-Cumming thinks it and Mauna Kea and Hualālai "are suggestive of three stranded whales" (*Fire Fountains* 1: 122). Gordon-Cumming knows the reason for the whale-ish appearance of all of the volcanoes: "apparently the whole distance to the summit of the mountain is an equally gentle slope, which is said to be due to its having been built up by successive flows of exceedingly fluid lava" (*Fire Fountains* 1: 126). But still, she is unimpressed.

Despite looking like a beached whale, Mauna Loa was quite difficult to summit: between 1779 and 1839 there were only three confirmed successful ascents of Mauna Loa (W. Barnard 67). So even though the mountain does not have imposing slopes, like Mont Blanc, it still is not easy to climb. Isabella Bird was able to ascend in 1872, which Bird said was "the most successful ascent of Mauna Loa ever made" (Bird 417). If Gordon-Cumming had wanted to, she could have made the ascent, but she decided not to because "the exertion would be very great, the cold severe, and I detest cold" (*Fire Fountains* 1: 145). Fortunately, Gordon-Cumming is able to see her own limitations; she says regarding Mauna Loa, "I frequently reprove myself for making severe strictures on its personal appearance. I tell myself that 'children and fools should not see things till they are done,' and that this ugly duckling may turn out a beautiful swan" (*Fire Fountains* 1: 123). She recognizes that the mountain is still growing and that she is seeing it in an unfinished state. Unfortunately, Gordon-Cumming wants Mauna Loa to grow or build like Mount Fuji or Mount Shasta, composite volcanoes, something that it will never

do as a shield volcano. In fact, Gordon-Cumming personifies Mauna Loa criticizing it for wasteful building, as if the volcano had control over the makeup of its lava. Still, Gordon-Cumming gives Mauna Loa the benefit of the doubt in the end, saying "Mauna Loa is an undeveloped young mountain of infinite energy and promise" (*Fire Fountains* 1: 123). As with other parts of the Hawaiian Islands, Gordon-Cumming recognizes that she does not quite have the perspective to appreciate the volcano. If she had taken the time to climb to the top of Mauna Loa, perhaps she would have had the opportunity to revise her opinion. Because of the severe cold, she chose not to. Gordon-Cumming did have the opportunity to revise her opinion of Kīlauea though.

To get a better look Gordon-Cumming decides to see the lake of lava up close. Kīlauea has a two mile wide summit caldera, which the Volcano House is on the edge of. Inside of the caldera, in the south-east corner, is the Halemaʻumaʻu pit crater, which, depending on conditions, one can still walk up to today. Gordon-Cumming describes her trek across the alien lava-scape in detail. She notes that from a distance the crater

> resembles a dark bluish-grey lake, being apparently a level surface. But on a nearer approach, we found it to be a bed of extremely irregular black lava contorted into all manner of forms, such as huge coils of rope, folds of rich black satin drapery, waves of glistening black glass forming a thin iridescent coating to a sort of bubbly red lava. (*Fire Fountains* 1: 157)

Gordon-Cumming is a keen observer of the various kinds of lava, describing the forms and patterns the lava took when finally cooled, and the differences between the kinds of lava, like the pāhoehoe, ʻaʻā, and Pele's hair. The hike was not completely empty of danger: "Sometimes, as we toiled along, the thin crust of fibrous lava gave way beneath our feet, and we landed in hollows below, at no great depth" (*Fire Fountains* 1: 159).

Whatever else might be said of Gordon-Cumming, her tenacity and courage are quite impressive. Few people would fall through the cooled surface of lava-bed in an active volcano and then decide to keep going. Nevertheless, Gordon-Cumming and her guide continue their hike through the crater, gazing upon the cyclopean forms of the lava "Indeed it requires small play of imagination to see these lava-beds all peopled with strange forms, such as the antediluvian monsters built up for our instruction at the Crystal Palace" (*Fire Fountains* 1: 162). Gordon-Cumming is referring to the dinosaurs, including the famous *Iguanadon*, which had been installed in the Crystal Palace in 1852. She would have been able to visit the Crystal Palace before she set off on her journeys in 1868. Gordon-Cumming is also connecting two important geologic studies, paleontology and volcanology, re-emphasizing that the scope of earth's history as indicated by volcanoes and dinosaurs is much longer than what many had assumed earlier in the century. Gordon-Cumming's comparison suggests geologic time, stretching between igneous rocks and terrible lizards. Although she does not completely grasp the time that Kīlauea stretches through yet, Gordon-Cumming can and will. Finally, Gordon-Cumming and her guide finally reached the temporary crags around Halemaʻumaʻu.

The most recent eruptions of Kīlauea had caused Halemaʻumaʻu to be surrounded by crags which "now form a ring 600 feet in height; and up this steep ascent we had to climb in order to look into the Lake of Fire" (*Fire Fountains* 1: 164). Up these temporary lava spires, Gordon-Cumming and her guide hike. Upon finally descending into Kīlauea, crossing the hot caldera, climbing up to the lip of Halemaʻumaʻu, Gordon-Cumming looks into Pele's home, expecting to see a lava lake or fire fountain, yet "THERE WAS

NONE! at least nothing worth speaking of, in the first instance. I turned to look at my guide, and he stood staring in stupefied bewildered amazement" (*Fire Fountains* 1: 165). The use of all capital letters further highlights the situation. Her frustrations are understandable: after all of this, hearing about the fire fountains from the other travelers, seeing the entries in the Volcano Diary, being reassured by her guide, and hiking across an active volcano, Gordon-Cumming was still stymied; Kīlauea would not be what Gordon-Cumming wanted it to be. The focus of those frustrations is the fact that Kīlauea does not appear as it should, according to Gordon-Cumming. Being in the volcano is not enough; it has to be active in a human sense. The paradox of the volcano is that its activity draws people to it, and it is active, yet rarely in the way that people want it to be.

Despite the fact that lava lake is not visible, Gordon-Cumming sits amongst the temporary crags of Halemaʻumaʻu and sketches for three hours (*Fire Fountains* 1: 167). There she sees "flickering flames of fire flashing from narrow fissures" (*Fire Fountains* 1: 167) which she highlights with alliteration. Gordon-Cumming takes her reader with her, to not only see but hear the flaring of the flames, with their quasi-'f' like sounds. The lava lake for Gordon-Cumming is quite active, even if its surface is not molten, because the heat and gases kept working and changing the rock inside. Every so often, as she watched some "internal fire seemed to explode, and upheaved a dome-shaped mass of molten rock of a glowing rose-colour, which burst like a rocket" (*Fire Fountains* 1: 168). Given these descriptions, what Gordon-Cumming sees is quite spectacular, something that few other human beings ever will. She admits that the view is quite good, but that expectations are hard to let go of: "You can quite understand that though under any other

circumstances I should have felt this to be a most wonderful sight it was not what I had so counted on seeing and so I naturally felt myself aggrieved and defrauded" (*Fire Fountains* 1: 168). Gordon-Cumming can recognize that she is in the middle of an amazing phenomenon, even if she feels frustrated that she did not get to see what she was hoping to. Her desire to see a particular kind of volcanism overrides her ability to enjoy anything else. Gordon-Cumming's expectations have locked her into thinking about Kīlauea in one way, stopping her from seeing it in any other manner. Halemaʻumaʻu did not appear as she had hoped because she was expecting a certain kind of volcano with a certain kind of energy. But Gordon-Cumming's disappointment was an aperture for her to realign her expectations with her perceptions, to better understand the unique way that Hawaiian volcanoes move through geologic time.

Gordon-Cumming stays at the Volcano House for seven days, October 28th to November 3rd, and in that time she finally gets to see the fire fountains in action. October 30th passes quietly for her: sketching Mauna Kea and exploring the forests around Kīlauea. But on October 31st Gordon-Cumming gets her wish. She does not record until November 1st, presumably too busy enjoying and investigating the volcano to write. Gordon-Cumming says "Last night was Hallowe'en—the great fire-festival of our ancestors—and here it has been celebrated in right royal style, for the fire spirits have broken loose, and are holding high revel" (*Fire Fountains* 1: 186). According to Gordon-Cumming, the crater of Halemaʻumaʻu suddenly became more active, and melted / overflowed the temporary crags, forming a new lava lake where she had been walking only two days before. Throughout the old crater and the new lake "fire-jets are spouting,

and molten lava thrown high in mid-air, great masses of red-hot solid lava being tossed to a height of from 40 to 50 feet" (*Fire Fountains* 1: 186). On this scene, with lava launched into the air, molten rock cascading like water, jets of flame puncturing the bed of the crater, Gordon-Cumming finally remarks "It is a scene of marvellous beauty, and is inexpressibly fascinating" (*Fire Fountains* 1: 186). As with the other Hawaiian scenery, Kīlauea refuses to be beautiful at first glance, but eventually Gordon-Cumming gets to see the beauty of the phenomenon.

Gordon-Cumming describes the action almost breathlessly trying to encapsulate the situation. The overflow of lava is described as "a network of living, rushing fire" (*Fire Fountains* 1: 186). The color of the lava is said to be golden, flame-colour, deep rosy-red, dull red, red gold, and quicksilver in motion. Gordon-Cumming uses adverb/verb combinations like "merrily flinging" and "playing gracefully" and "suddenly bursting." She even incorporates the sound of the spouting chimneys, saying that they erupt "sometimes silently, sometimes with puffing and spluttering, varied with a roar like an angry bull; then a hush, followed by low moaning sobs" (*Fire Fountains* 1: 187). What Gordon-Cumming was looking for was violence: the melting, rending, bursting, breaking, overflowing of the earth, what one traditionally expects from volcanoes, even liquid ones like Mauna Loa or Kīlauea. The lava lake delivers on the violent promise of volcanism, which is one of the main tensions in Gordon-Cumming's description of the eruption: the contrast between beauty and violence. Much of the scene is cast in violent terms like burst, thrown, break, commotion, heaving, fireworks, angry, moaning, explosive, torpedo, rocket, writhe, agonised, violent, and dying (*Fire Fountains* 1: 186-

88). The action of the lava fascinates Gordon-Cumming, as she watches a mass of lava in the crater preparing to overflow once more "Then, again, the lava seemed to writhe and twist, as if in agonised contortions, and then commenced a violent boiling and bubbling preparatory to its bursting into active fire fountains" (*Fire Fountains* 1: 188). The lava is described as if it were in pain, and many of the words used to describe the movement of the liquid rock are violent. As was expected with volcanoes, the reshaping of rock is violent. Unlike other volcanoes, Gordon-Cumming can watch this reshaping without being in great peril, which allows her to see the eruption as more than just violent.

The eruption is also a "marvellous beauty" that is at various points a playful, sportive, and merry in addition to being a wide variety of colors. The mixing of the violent and the beautiful, ideas that are at times thought of as opposite, is intriguing. As aesthetic objects, volcanoes are beautiful in their dynamism, as they take otherwise static matter and reshape it. And certainly, lava flows and volcanic eruptions can be beautiful. But the relative safety of Gordon-Cumming's location on the edge of the caldera should not be forgotten either: the only reason she is able to enjoy the volcano is because she is not in imminent danger. The characters in *The Last Days of Pompeii* do not get to sit around calmly and enjoy the sight of Vesuvius's eruption, instead they have to flee or die, and even those that run still might die. While this difference between volcanoes caused disappointment for some Victorian visitors to Hawai'i, it was crucial for understanding volcanoes and the mechanisms of the earth. Once the visitors had the chance to reconsider their initial feelings, they started to see how volcanoes like Kīlauea and Mauna Loa stretch through geologic time. What is required to take a phenomenon like a volcano,

that is quite deadly, and turn it into a beautiful object is some safety, some distance, which is what Gordon-Cumming gets to experience.

Gordon-Cumming watches the eruption of Kīlauea all day and into the night. To assist Gordon-Cumming's viewing, her "kind landlord rigged up blankets and lanterns to make me a snug sketching point on the hill above this house" (*Fire Fountains* 1: 189). The scene at night is far different from the day, as Kīlauea transforms into a huge smelting factory but one that is a "ten thousand times" brighter. The colors expand to include the "deepest chocolate, crimson, and scarlet, to orange, yellow, and primrose tints, and the silvery grey becomes tinged with pink and violet, while the solid rocks become ever more intense in their blackness" (*Fire Fountains* 1: 189). The brilliance and the uniqueness of the scene capture Gordon-Cumming as she watches the ongoing eruption, to the point that she might even have forgotten to sleep.

The eruption was so overwhelming that Gordon-Cumming reports "I had little time for sleep. So often as I lay down, the fascination of the scene recalled me" (*Fire Fountains* 1: 189). She goes on to say that the color of the lava changed in the light of the rising sun (*Fire Fountains* 1: 190), which seems to indicate that Gordon-Cumming stayed awake all night, or at least stayed outside for a good portion of the night watching and sketching the new lava. Also, the desire to see the lava up-close is reignited within Gordon-Cumming. She says "I am longing to go down into the crater and have a nearer view of the rivers" (*Fire Fountains* 1: 190) but follows that up by noting that it is probably too dangerous. She recognizes the danger of going into the caldera, but still wants to. Further, the letters seem to indicate that Gordon-Cumming stayed awake almost

forty-eight hours, or was at least watching the development of the lava lake and its outflowing rivers with incredible intensity for forty-eight hours, with time to sleep somewhere. She already said that on the first night she stayed up watching the eruption until the rising sun arrived. In the next letter she claims that "All last night, and the night before, we watched the marvellous scene" (*Fire Fountains* 1: 190). The eruption of Kīlauea is of great importance to Gordon-Cumming, and she does not want to miss any of the changes in the caldera. Her experiences are quite complete, except for one detail. The final experience for Gordon-Cumming would be to see the rivers of lava up close, see them like few others have before, despite the danger.

Gordon-Cumming gets her wish and descends into the active caldera with her guide again. Along with another traveler, Gordon-Cumming and her guide walk between the streams of lava, to get up close to the various chimneys and lava pools. Gordon-Cumming reports on the lava, noting the changes as it emerges, recording that the pāhoehoe lava advances in a wave which "gradually solidifies it travels slower and slower till it halts altogether forming a hollow tube" (*Fire Fountains* 1: 193). Then, she records, afterwards another new wave will come, which will form a second tube, and so on. Gordon-Cumming's description is in many ways similar to Dutton's, who also notes that the surface of the pāhoehoe cools as it travels. Once cooled "the superficial crust of cooled lava undergoes rupture at numberless points, and little rivulets of lava are shout out under pressure. Preserving their liquidity for a short time, they spread out very thin and are quickly cooled, forming pahoehoe" (Dutton 96). Gordon-Cumming provides as

accurate a description of pāhoehoe as Dutton, showing her readers the strange nature of one kind of Hawaiian lava.

The lava cools in such a fascinating fashion that Gordon-Cumming collects a few specimens of it, even though she describes herself as typically uninterested in collecting rock samples (*Fire Fountains* 1: 176). Her guide is also interested in specimens, but unlike Gordon-Cumming he makes them "by embedding copper coins in the hot lava" (*Fire Fountains* 1: 195). Gordon-Cumming is not especially impressed by her guide's specimens, considering them inferior to the unadulterated lava specimens of the volcano which she collected. As with other parts of her Hawaiian journey, Gordon-Cumming seems to be attracted to the picturesque idea or ideal of Hawai'i. At other points she criticizes the importation of plants (*Fire Fountains* 1: 15) or the changing dress of the Hawaiian people (*Fire Fountains* 1: 23). The impressing of the coin into the lava is undesirable because the lava does not cool properly, i.e. naturally. Further, placing the coin in the lava breaks the barrier between the natural and artificial, which Gordon-Cumming does not like either. The coin ruins the otherwise picturesque nature of the lava. The human interference with a "natural" object is displeasing to Gordon-Cumming. To be pure or whole, objects, be that a lava specimen or a collection of native peoples, need to remain untouched by civilization. That division sets a dangerous course though, as it misunderstands the relationship between human beings and other human beings, or the ecological structures that human beings live in.

Gordon-Cumming and her party spend the entire day within the caldera and are not injured. Their clothes and shoes are not even damaged, according to Gordon-

Cumming. Interestingly, Gordon-Cumming points out that her own ability to scramble over rocks and tip-toe around lava rivers is somewhat out of character: "Knowing my limited powers of walking, you will wonder how I could possibly get over so much ground. I suppose the all-absorbing interest gives one double energy; and then the lava is really not unpleasant to walk upon" (*Fire Fountains* 1: 196). Gordon-Cumming does not admit to any difficulty of movement in any other part of the travelogue, nor does she seem especially taxed when it comes to walking. No doubt though, it was because her audience knew her well enough that she did not feel the need to dwell on her limited powers. Regardless of what the limits are, that Gordon-Cumming was able to overcome them because a fascination with the fire fountains speaks to the particular sway that Kīlauea had over her. After the emotional frustration with the initial sight of the caldera, the further consternation with the lack of a lava lake in Halemaʻumaʻu, the desire to climb into the crater, the excitement and joy upon the sudden eruption of Kīlauea, the manic way that Gordon-Cumming goes about drinking in every experience she can while the lava pours forth from the earth is no surprise. Thanks to her disappointment, Gordon-Cumming is all the more engaged in experiencing Kīlauea, giving herself the opportunity to conceptualize geologic time. Volcanic elements, because of the danger and violence, were challenging to see through time in the nineteenth century. The Hawaiian volcanoes allow Victorian scientists and travelers the chance to see geologic time in a new way. Gordon-Cumming arrives at this new understanding of geologic time by contrasting her experiences against previous igneous excursions.

Kīlauea is not Gordon-Cumming's first experience adventuring in and around areas of volcanism. One of the points of reference she has for volcanism is the north island of New Zealand, which she visited earlier in Pacific travels. Before the eruption of Kīlauea, she comments: "What chiefly impressed me was the strange stillness of the scene, as compared with the thunderous raging and roaring I have heard in the volcanic regions of New Zealand.[1] To-day I heard occasional slight detonations, and sounds as of falling rocks, but nothing exciting occurred" (*Fire Fountains* 1: 148). The footnote says "At Home in Fiji, vol. ii., chaps. xxiv. and xxv." referring the reader to that book. Those chapters cover Gordon-Cumming's adventures in the Taupo Volcanic Zone and other features of New Zealand. The Taupo Volcanic zone is in some ways similar to Yellowstone in the United States in that there are large number of unique geologic features like mudpots or geysers. There Gordon-Cumming visited a whole variety of igneous phenomena like hot lakes and mud volcanoes. She even got to see the famed White Terraces. The terraces were a set of step-like formations that were made from the precipitation of silicic acid and sodium chloride from geothermally heated water. These terraces were destroyed in 1886 after the eruption of Mount Tarawera. In another footnote in *At Home in Fiji* Gordon-Cumming reflects on the differences between the Hawai'i and New Zealand volcanic areas. She places the footnote after commenting that the New Zealand volcanic regions must be second only to the Hawaiian ones. The footnote erases the idea that the two zones are even comparable: "Since the above was written I have spent two months in the Hawaiian Isles, and have lived a never-to-be-forgotten week on the very brink of the great active crater. I consider that it is wellnigh

impossible to compare the two scenes" (*At Home in Fiji* 2: 202). The footnote continues on to say that on Hawai‘i one can view the earth's forge, where in New Zealand one can see nature's laboratory. For Hawai‘i Gordon-Cumming uses words like mighty, awe, overwhelming, and says the area is "unlike any other scenes in creation" (*At Home in Fiji* 2: 202-203); whereas Taupo is described with the words strange, beautiful, and infinite variety (*At Home in Fiji* 2: 203). Even when compared to similar space of volcanism, Kīlauea is still more sublime to Gordon-Cumming, stronger and mightier than other places, despite her initial disappointment. By distinguishing between forge and laboratory, Gordon-Cumming shows how her experiences with Hawaiian volcanism have started her thinking about time and the earth. Hawai‘i as a forge suggests construction over time, which she was aware of, but the distinction between volcanic zones means that Gordon-Cumming is perceiving the different mechanisms of the earth and how they operate over geologic time. After her initial enthusiasm, disappointment, and then reflection, Gordon-Cumming sees how different kinds of volcanism operate upon the earth.

Constance Gordon-Cumming was certainly not the first Victorian traveler to visit Hawai‘i nor the first to write about it. Her experiences are important because of the ways they are similar and yet also different from others. The famous Isabella Bird (1831-1904) visited the islands in 1872 and published her letters in *The Hawaiian Archipelago* (1875). Likewise, Anna Allnut Brassey (1839-1887) visited Hawai‘i in 1876 during her family's eleven month voyage through the Pacific, and published her account in *A Voyage in the Sunbeam* (1878). Bird's journeys throughout Hawai‘i were much more adventurous that

Gordon-Cumming's: Bird camped near Kīlauea twice, hiked up Mauna Loa, and visited a number of the other islands. Bird's first view of Kīlauea is exceedingly cinematic, with her company reaching the crater's edge in darkness that "could be felt," Bird wondering whether she saw a "pool of blood" and then the "largest active volcano in the world" comes into view in all its glory (Bird 77-78). Unlike Gordon-Cumming, Bird is immediately satisfied with her view and experience of the volcano: "My highest expectations have been infinitely exceeded, and I can hardly write soberly after such a spectacle, especially while through the open door I see the fiery clouds of vapour from the pit rolling up into a sky, glowing as if itself on fire" (Bird 80). Bird's exploration of Kīlauea mirrors Gordon-Cumming's, as they both view the caldera from afar, then hike down inside of it to get a closer look at the fire fountains in action. When Halemaʻumaʻu awakens in front of Bird and her companions, throwing "gory drops" into the air she exclaims "I think we all screamed, I know we all wept, but we were speechless, for a new glory and terror had been added to the earth. It is the most unutterable of wonderful things" (Bird 83). The spectators on the edge of Halemaʻumaʻu are so overcome by the exploding and flowing molten rock that they both scream and cry. Despite writing after the fact Bird, like Gordon-Cumming, gushes about the scene and describing it as indescribable. Kīlauea's activity does not disappoint Bird, but she was also prepared to be dissatisfied with the view.

Bird is aware of the distinct nature of the volcano and its potential for disappointment. Before she sees Halemaʻumaʻu, Bird was worried about being disappointed as the crater had seemingly gone quiet: "Indeed, I had been making up my

mind for disappointment since we left the crater-house, in consequence of reading seven different accounts, in which language was exhausted in describing Kilauea" (Bird 83). Even as she is travelling across the cooled lava of the caldera, Bird continues to worry that Kīlauea had decided to go silent upon her approach. Thanks to her research, Bird knows that Halemaʻumaʻu is dynamic, always changing. She wants to see the lava lakes, the fire fountains, and the violent upheaval of the earth, scenes that are possible on Hawaiʻi but not guaranteed. Early on, Bird notes that "We think of a volcano as a cone. This is a different thing" (Bird 79). Bird's foreknowledge of the shape and nature of the volcano means that she can correctly contextualize her potential experiences; she is ready for disappointment and has played through the scenario in her mind. The pre-disappointment is already primed her for the ways that Kīlauea occupies geologic time. Her analysis of time is completed during her second visit to the volcano. Bird says that,

> Kilauea is altogether different from the European volcanoes which send lava and stones into the air in fierce sudden spasms, and then subside into harmlessness. Ever changing, never resting, the force which stirs it never weakening, raging for ever with tossing and strength like the ocean: its labours unfinished and possibly never to be finished. (Bird 392)

Bird draws a distinction between composite volcanoes and shield volcanoes, noting the differences in their eruptions and their results. Importantly, she describes Kīlauea's eruptions as labors and says these labors might continue indefinitely, suggesting both the constructive nature of the volcano and the way that Kīlauea stretches through time, building and building beyond human time. While Bird was not disappointed upon seeing Kīlauea she was prepared to, giving her the same chance to see the volcano differently and grasp its space in geologic time.

Similarly, Anna Allnut Brassey is another Victorian traveler that visited Kīlauea. The Brassey family travelled on the *Sunbeam* around the globe, from England south around the Cape Horn, into the Pacific, then through the Indian Ocean, and finally returning to Europe through the Suez Canal. Like Bird, Brassey arrives at the volcano in the evening, in a very cinematic fashion, "The scene was certainly one of extreme beauty. The moon was hidden by a cloud, and the prospect lighted only by the red glare of the volcano" (Brassey 264). Also like the other two writers, Brassey experiences some disappointment: "Yet the first sensation is rather one of disappointment, as one expects greater activity on the part of the volcano" (Brassey 265). As usual though, eventually the beauty of the volcano grows in Brassey's mind. Of course, the following day, the party ventures into the caldera and treks to the pit crater, which Brassey finds sublime beyond words. She says "It was all terribly grand, magnificently sublime; but no words could adequately describe such a scene" (Brassey 268). Brassey's experiences likewise mirror the others in her move from disappointment to delight. Except that Brassey never seems to connect with the geologic time that Gordon-Cumming and Bird do. Brassey though is solely focused on the activity of the lake, and does not comment on the structure of the islands or the volcanoes, suggesting that merely seeing Kīlauea was not enough to inspire one to see geologic time, but that Victorian travelers had to take an interest in geology to connect with deep time.

There are obviously quite a few similarities between these accounts, although Gordon-Cumming's fits the pattern the least. Still, it seems that some Victorians, upon seeing Kīlauea for the first time were somewhat underwhelmed. Kīlauea's structure as a

shield volcano, in lieu of the more imposing composite volcanoes like Vesuvius, means that inevitably visitors were going to be disappointed because the lack of verticality. Bird notes this in her work, saying that the "Volcano Book," was filled with "immense quantity of flippant rubbish, and would-be wit" (Bird 88) and assessment that Gordon-Cumming echoes (*Fire Fountains* 1: 147). Of course, the three travelogues referenced here all note in some manner or form their disappointment, so one would assume that a potential visitor would be prepared for a let-down. Bird notes that she read multiple accounts which prepared her for disappointment, likewise Brassey read Bird's account, and Gordon-Cumming did not seem unaware of the possibility of a quiet volcano. Nevertheless, disappointment was experienced, even in a minor fashion, by all three. The reason seems to be because the ideal form of volcano is still Vesuvius: an imposing composite volcano looming over an idyllic town. Gordon-Cumming confirms as much when she laments that Mauna Loa does not look like either Mount Fuji or Mount Shasta both composite volcanoes (*Fire Fountains* 1: 123). The composite volcano maintains a hold the imagination of these travelers, regardless of how they prepare themselves.

Eventually the travelers' expectations fall away as they get to experience an eruption first-hand. The process of seeing the lava flowing, breaking, and being thrown into the air overcomes them. The travel writers all report that the scene is indescribable in some fashion. While there is irony in describing a feature as indescribable, the trope speaks to the overwhelming nature of volcanoes, even effusive ones like Kīlauea. The writers finally experience the sublime nature of the volcano, as its age and power and depth all collide in a single moment. The sublime experience that the travelers have

seems to allow them to contextualize human existence within the environment, if only for a few moments. And they report these sensations for a wider audience to experience, if only second-hand. The communication of this particular environmental phenomenon, Kīlauea, is important because it helps disrupt the narrative that human civilization can control nature. Other kinds of scientific and travel writing collude with the Western colonial project, where the narrative is one of civilized power over the savage world. Empirical accounts of volcanoes show the environment as it is: with the human race one piece in a larger system. The difficulty though is recalling these experiences to mind over time. Gordon-Cumming, specifically, can remember that the volcano was sublime but not the particular sensation of sublimity, and so in her writings she forgets and recontextualizes.

Gordon-Cumming's journey to Kīlauea and adventures in and around the volcano are quite spectacular. Few people are able to see Kīlauea in a moment of apparent quiescence and then in a flurry of activity. Most of the first volume of the travelogue is focused on Gordon-Cumming's interaction with the volcanoes of Hawai'i or her learning about them through other sources. The second volume contains one last letter from Gordon-Cumming's journey, and then is dedicated to a history of the Christianization of Hawai'i. The second volume is much more explicitly religious, and even uses an eruption of Mauna Loa as a didactic moment to show how the worship of a Christian God is better or more correct than the worship of Pele or any of the Hawaiian gods (*Fire Fountains* 2: 279). Gordon-Cumming's admonition is in in contrast with her letters from the Volcano House though. Unlike typical geologic speculation, in the first volume Gordon-Cumming

does not say or imply that the volcanoes are in some way a demonstration of the power of God. As Martin Guntau points out, at least at first, the study of the world and geology in particular "was designed to render the scale of God's natural creation comprehensible and to affirm Christian faith" (Guntau 216). The second volume deploys volcanoes as a religious moment. Gordon-Cumming even ends the entire work by saying of the now converted Hawaiians "So day by day do they walk in the midst of the flows, fearing no evil, as those who believe that the Fire-floods will not be suffered to overwhelm them, because One, Who is the true Lord of the Fire, is ever present to shield them from its power" (*Fire Fountains* 2: 279). The previous chapters in the second volume of *Fire Fountains* reinforced the message that God would protect his worshippers from the destruction caused by the volcanoes. Gordon-Cumming's portrayal here plays into the literary trope of Kīlauea; as Looser argues the usage of volcanoes in dramatic texts was ultimately part of the colonial project (Looser 363). Gordon-Cumming's usage in the second volume certain endorses colonial missionary work. Her second volume has a tonal contrast when talking about the volcanoes, where they become controlled by God, in comparison to the first volume, where volcanoes are not controllable.

One would assume that Gordon-Cumming, given the time the travelogue dedicates to the Christianization of Hawai‘i would use the volcanoes as evidence for the power of God in the first volume. Yet, early on before the eruption, she says of Halema‘uma‘u and volcanoes in general "thus the work of construction and destruction is ever going on hand in hand, both alike aimless, so far as we know" (*Fire Fountains* 1: 169). If volcanoes are a product of God, then they cannot, or should not be aimless.

Gordon-Cumming's volcanic ambivalence is a product of the shift in volcanic understanding that was occurring as early as the 1830s. The impact of works like Edward Bulwer-Lytton's and Charles Lyell's are evident in Gordon-Cumming's writing fifty years later. As she is leaving Kīlauea, the enigmatic nature of volcanoes returns and Gordon-Cumming says again that Halemaʻumaʻu might erupt in activity or cool completely and then ends "But who can tell?" (*Fire Fountains* 1: 197). In either of these quotations, one would expect Gordon-Cumming to slip in a reference to God, like "who can tell but their Creator?" Instead she just leaves the space empty. Andrea Feeser argues that Gordon-Cumming is in the second volume is trying to contain the incredible experiences she had in the first volume using Christian theology (Feeser 100). The difference between the ways the two volumes deal with volcanoes is quite wide. Given that the travelogue is published in 1883, but written in 1879, it is possible that the missionary history was added on later. Gordon-Cumming's initial reactions to the volcano are contained in the letters published in the first volume, and the second volume was another thought, perhaps added to make the book more marketable and profitable. The distinction between the two volumes suggests that even though volcanoes had less religious meaning in Britain than earlier in the century, there was still some uncertainty about geologic time, especially the way that geological time seemed to decontextualize human life, or make it an endnote to a narrative that was fundamentally uninterested in human existence. Advertisements for the travelogue even suggest the religious component is the best part of the work.

One of the first notices of publication is a brief note on October 7th, 1882, in *The Bristol Mercury and Daily Post* which says "Miss C. F. Gordon Cumming's new book will be entitled 'Fire Fountains.'" ("The Reviews"). The notice also says that the work will be in two volumes, and will include both a map and illustrations. An advertisement in *The Morning Post* on December 16th, 1882, lists the illustrations that accompany the book ("Multiple Advertisements and Notices"). There are eight illustrations in the text, all of which Gordon-Cumming drew herself, and of those eight, seven show the volcanoes in some fashion. The emphasis on the illustrations in both of these advertisements indicates that the sketches done by Gordon-Cumming were a selling point. Despite the fact that half of the two volumes is given over to the Christianization of Hawai'i, there are no illustrations of any of the churches or the history of Hawai'i. Instead, for example, jammed between discussions of the efforts of Hawaiian chiefs to accept an American missionary group, a move that was opposed by the British consul and a variety of sailors, there is an illustration titled "Fire Fountains. Temporary Chimneys." (*Fire Fountains* 2: 112-13). There are very few figures in the sketches and none of sketches are related to the historical narrative Gordon-Cumming tells.

Regardless, the travelogue is published at the last moment in 1882. The *Glasgow Herald* announces on December 18, 1882, that "This day is published" in octavo format for twenty-five shillings "Fire Fountains" ("Advertisements & Notices" 18 December 1882). *The Pall Mall Gazette* advertises Gordon-Cumming's work as one of the "Books for Christmas Presents" ("Advertisements & Notices" 22 December 1882). The work appears to be well received with the *Morning Post* saying "the book will compare with

any of her previous efforts, and is as well worth reading, as instructive, and enjoyable as 'At Home in Fiji,' the best praise that could be awarded to it" ("Multiple News Items" 28 December 1882) and *The Pall Mall Gazette* saying "What with pen and with pencil, Miss Cumming describes what she sees well and graphically; and we have read nothing heretofore about these great open volcanic displays that brought their main features so vividly before the mind's eye" ("Miss Gordon Cumming on Hawaii"). As the book started to circulate, more reviews were published lauding Gordon-Cumming.

One review in *The Morning Post* said of Gordon-Cumming that "There are comparatively few men, and probably no other woman [*sic*], who have seen so much of the world as Miss Gordon Cumming" ("Multiple News Items" 28 December 1882). *The Morning Post* notes that Gordon-Cumming is an experienced traveler, capable of using any mode of transportation, and a cogent writer, able to condense a broad scope of knowledge down for her readers. Interestingly, *The Morning Post* also catches Gordon-Cumming's disappointment upon viewing Kīlauea, describing the volcano as "a sunken pit, over nine miles round, six hundred feet deep, and paved with bluish lava that looks like leaden-coloured water" ("Multiple News Items" 28 December 1882) but then the review launches into a racist screed against the Chinese which seems to have little to do with Gordon-Cumming's work. Despite that, *The Morning Post*'s review rights itself, claiming that "although the author's accounts of the volcanic system of Hawaii […] are highly interesting […] the value of the work depends on the picture it gives of the country and people who are so bright a jewel in the cap of civilisation in the Pacific Archipelago" ("Multiple News Items" 28 December 1882). At least for *The Morning Post*'s review, the

Christian aspects of the text were the best and that "No better work of the kind on Hawaii has appeared, and 'Fire Fountains' will be valuable to all who take an interest in the islands and their population" ("Multiple News Items" 28 December 1882). *The Pall Mall Gazette* though is much more focused on the volcanic aspect of the work: "The most interesting part of Miss Cumming's book is that which gives a title to the entire work—her narrative of her tour among the volcanic lakes and craters of the main island. Of these extraordinary and fiery scenes she gives us several admirable sketches, […] unsurpassed in their way for weird sublimity and awe-inspiring grandeur" ("Miss Gordon Cumming on Hawaii"). The review shows that not only does Gordon-Cumming record her experiences but that those experiences were interesting and valuable to her contemporaries; people read her work because of what it could tell them about being around an active volcano. Gordon-Cumming helped bring a particular experience to her readers allowing them to understand volcanoes in a fashion that many of them never would.

Gordon-Cumming's narrative of her journey to Kīlauea shows her readers the sublime nature of a volcano on a human time scale. Krakatoa, even though its eruption was only a few short hours, surpassed human cognition: there was no way that anyone could actually make sense of the explosion as it happened too fast. Kīlauea, even though it arguably is going to alter the world more than Krakatoa ever will, is slow enough that human beings can gather more information about volcanos. Seeing a slow eruption, which still has the power to shape the land and destroy human life, helps demonstrate the constancy of volcanic action; volcanoes become less random, even if they are still fairly

meaningless. The problem, though, is that Kīlauea does not match the standard conception of a volcano, the composite volcano. Gordon-Cumming shows that with her disappointment at first seeing Kīlauea. But eventually the power of the volcano dawns on her, once she sees it in action, or at least action as understood by human beings. One of the benefits is that her narrative reached a larger audience than any of the scientific accounts like Dutton's, and showed how a volcano, especially one that is of a different composition, acts and interacts with its environment and how relatively small human beings are in comparison to those actions.

Krakatoa, and other composite volcanoes, were the standard by which all volcanoes were measured in the Victorian period. Steep-sided, explosive volcanoes though are more difficult to see through geologic time because the sudden and random nature of the explosions. The Hawaiian volcanoes provided an alternative way to see the effects that volcanoes have through time, because the effusive and frequent eruptions typical of volcanoes like Kīlauea. Victorian scientists and travelers had the opportunity to report on these distinct igneous phenomena. But these visitors to Hawai‘i needed to first overcome their own expectations that volcanoes should be like Krakatoa or Vesuvius. Many, like Dana, Gordon-Cumming, and Brassey, were disappointed at first. Disappointment though was an opportunity to reconsider the volcanoes and the way that they moved through geologic time. Once these visitors had the opportunity to pause and reexamine the volcanoes, they became overwhelmed by the scope of geologic time they suddenly perceived. Gordon-Cumming's experiences are especially instructive because of just how disappointed but then how elated she subsequently became. Hawaiian

volcanoes were not the tool by which geologic time became easily accessible, and the volcanoes were utilized to reinforce colonialist assumptions about the Hawaiian Kingdom. But the experience and descriptions of Hawaiian volcanoes in both scientific treatises and popular travelogues allowed for a more complete perspective on geologic time. Understanding these volcanoes allowed for a more holistic account of the igneous networks of the planet, especially the ways that volcanoes continued to be both destructive and constructive. Gordon-Cumming's disappointment, like that of other Victorian visitors was an aperture for a more complete grasp of the scope of geologic time and the ways that volcanoes move through that time, reshaping the earth and the lives of people.

M. P. SHIEL'S VOLCANIC HOPE

Mass extinctions, like the Cretaceous–Paleogene extinction which killed the dinosaurs, would have been unfamiliar to late nineteenth-century audiences. The idea of a force, like an asteroid or massive volcanic eruption, destroying all life on the planet would not have been unexpected though. H. G. Wells believed mass extinction might be possible, saying in the *New York Times* that "It is conceivable, [that a meteor or disease could] utterly destroy every spark of life upon this earth" (Wells). Advances in scientific work during the fin-de-siècle already suggested that citizens of the British Empire were devolving, aristocratic blood was weakening, and the lower classes were turning into criminals. The decay was not confined to society. Thermodynamics revealed that all energy was eventually turned into useless heat, that coal supplies were running low, and that the Sun would soon be exhausted. M. P. Shiel's apocalyptic novel, *The Purple Cloud* (1901), addresses the slow drain of energy both in human civilization and the earth. But Shiel's novel is not fatalistic, instead presenting a hopeful extinction; a geologically focused, environmental novel for the turn of the century. *The Purple Cloud* uses renewed geologic energy from volcanoes and continental drift to create a new human species. While the novel is rife with fin-de-siècle themes which have been noted by previous scholars, its geologic phenomena have received little attention. These phenomena are important because they help recast the novel as optimistic about the environment's impact on human life. *The Purple Cloud* shows how people are influenced by volcanoes and the environment can reshape society for the better.

Matthew Phipps Shiell (1865-1947), who used the pen name M. P. Shiel, was a British science-fiction writer of West Indian descent. He was born on Montserrat, the child of a merchant/lay Methodist minister and a "free" woman (*M. P. Shiel: A Biography* 12). Christianity was a defining element of Shiel's young life: his father ruled the "house in an Old Testament manner" (*M. P. Shiel: A Biography* 34). The impact of religion on Shiel was strong: he spent the last decade of his life translating the Book of Luke (*M. P. Shiel: A Biography* 99). Religion was not Shiel's only interest: he also was fascinated by the sciences, especially chemistry. When he was old enough, Shiel attended Harrison College in Barbados, where he worried about the balance of his education: "two hours a week of chemistry and the four of Greek was a crazy state of things" (Shiel qtd. in *M. P. Shiel: A Biography* 85) suggesting he thought that there should be more science and less Greek. After 1883 Shiel lived in London, where he studied medicine for a time (Vogeler). His first commercial success was *Prince Zaleski* (1895) a short story collection, which was well reviewed by a wide range of commentators (*M. P. Shiel: The Middle Years* 35). Shiel would continue to publish up until the last decade of his life.

The Purple Cloud (1901) is Shiel's best known novel. Shiel's fame, though, was limited, even in his life-time. An advertisement in the *Times Literary Supplement* for Shiel's work says that his "is a name unknown to the general public, but one which has been talked of in literary circles for nearly thirty years" ("M. P. Shiel") in 1929, eighteen years *before* Shiel's death. Initially *The Purple Cloud* was serialized in *The Royal Magazine* from January to June of 1901 (*M.P Shiel: The Middle Years* 110) and "*The Purple Cloud* was published that fall [of 1901] by Chatto & Windus" (Squire 14). The

novel seems to have been largely well received upon publication. One review stated "The book shows very decided power, and the author has undeniably a vivid and original imagination" ("London Letter"). Another critic commented that "There is a genius in Mr. Shiel, and when he fully masters himself and learns the value of restraint he will do good work. Meanwhile his books interest the public and sell largely" ("Mr. Alden's Views"). Billings claims the serialized version of *The Purple Cloud* "caught the attention of many young Edwardians" (*M.P Shiel: The Middle Years* 110). Despite his only slight fame during his life, Shiel's novel is an important entry in the apocalypse/post-apocalypse genre because of how it focuses on the human-environment relationship.

The novel follows the tradition of the "Last Man" narrative, which started at the beginning of the nineteenth century in a variety of works, like Mary Shelley's *The Last Man* (1826). The protagonist of Shiel's novel is Adam Jefferson, a medical doctor with scientific training who joins an expedition to the Arctic. The expedition is pyrrhic: Adam does make it to the North Pole, becoming the first man to do so, but everyone else on the expedition is killed or dies. Afterwards, Adam makes his way back to the more inhabited latitudes to find that everyone is dead because of a strange purple cloud that smells like almonds. After confirming the near extinction of the human race Adam sets about burning down the remnants of civilization, like London, and building a colossal palace to himself on the island of Imbros in the Mediterranean. During a worldwide pyromaniacal spree, Adam discovers that a gigantic volcano, or volcano complex, northeast of New Zealand erupted the same day he reached the North Pole spreading the purple ash cloud throughout the globe. Undaunted, Adam returns to Imbros, and continues his pyromania

in Constantinople. His fires release an eighteen-year-old girl, who names herself Leda. Due to his misanthropy, Adam struggles mightily with his feelings and desires for Leda, even shooting her at one point. But Leda manages to trick Adam into having sex with her by claiming that purple cloud has returned. The novel ends with Adam acknowledging the return of human life, albeit a new, different form of human life.

One theme that scholars of *The Purple Cloud* have tracked is the intersection of decadence and degeneration. William Svitavsky states that the novel expresses "both a sense of human degeneracy and a Decadent's disdain for fallen humanity" (Svitavsky 15). Early on in the novel, Adam's wife, Clogdah, explains her fascination with drugs: "In these days of 'the corruption of the upper classes,' and Roman decadence of everything, shouldn't every innocent whim be encouraged by you upright ones who strive against the tide? Whims are the brakes of crimes: and this is mine. I find a sensuous pleasure, almost a sensual, in dabbling in delicate drugs" (*The Purple Cloud* 32). Clogdah claims that to maintain her innocence she needs to dabble in drugs and poisons. Further she suggests that hobbies somehow stop people from committing crimes. Without recognizing any of the irony, Clogdah both references and exemplifies "the corruption of the upper classes" showing how society is decaying socially and morally. Importantly, Clogdah poisons a member of the Arctic expedition, which allows Adam to go on the adventure as a substitute. She hopes that her husband will arrive at the Pole first and win the $175 million prize for doing so (*The Purple Cloud* 15). Adam does arrive first but also seems to precipitate the collapse of the monetary system. The world that Adam left to go to the Arctic was decadent and corrupt where poisoning and murder were

acceptable. The decadence Adam sees spurs his misanthropy, causing him to rejoice in the destruction of human civilization.

Shiel's text is also Orientalist. After the volcanic eruption Adam slowly adopts an Oriental mode of life, which he explains by saying "I cannot quite state why the tendency toward Orientalism—Oriental dress—all the manner of an Oriental monarch—has taken full possession of me: but so it is: for surely I am hardly any longer a Western, 'modern' mind, but a primitive and Eastern one" (*The Purple Cloud* 221). C. J. Keep sees Adam's "active submission to a feminine other as a form of desire only available to him at the end of time, an act which is, paradoxically, precisely the condition of a return to phallic potency" (Keep 132). Svitavsky, building on Keep's argument, claims that the marriage of Adam and Leda is Shiel's antidote for modern decay, that only "through union with the inferior, primitive East can the last modern, Western man be regenerated" (Svitavsky 19). Monique Morgan sees the narrative instability of the novel as a key element that warps some of the more distasteful orientalist positions Adam adopts. Morgan, in part, pins this instability on degeneration: "Adam's behavior during his isolation is also consistent with the late-nineteenth-century association of insanity with degeneration" (Morgan 271). Between the pyromania, orientalism, palace-building, and the potential return of the human race, the novel overflows with entangled concerns about decadence and degeneration. Yet the novel also addresses concerns about human connections with the environment.

One of the most recent scholars to comment on *The Purple Cloud*, Ailise Bulfin, argues that "the ultimate logic of reconciliation in *The Purple Cloud* is revealed through

the resolution of a series of dialectical oppositions […] secular, scientific theories of the end of the human race are in fact updated forms of religious belief" (Bulfin 173). Bulfin makes a very strong argument that Shiel combines scientific conceptions of time with philosophical ones to come to a reconciliation of binaries. Geological understandings of time play an important role in her claim. Bulfin says that Shiel uses a combination of catastrophist geology, reports of other volcanoes, and personal experience to craft his own "particular version of the end of time" (Bulfin 167). A variety of geologic evidence supports Bulfin's argument, such as the theories of Lyell and Cuvier, the volcanic nature of Shiel's home Montserrat, and the recent eruption of Krakatoa. For Bulfin these pieces of evidence build towards a particular understanding of time in the late Victorian era. Bulfin's claim helps establish linkages between religion and science at the beginning of the twentieth century through geology. Importantly Shiel's usage of chemical, geological, and thermodynamic knowledge not only links science with religion, but allows him to use environmental determinism to reshape the human race. *The Purple Cloud* contains a complete geo-ecological system, where volcanoes motivated by continental drift change human evolution for the better. To reshape human life, Shiel does not start big though, in fact he does not even start small; he starts at a molecular level using his first passion, chemistry.

While a purple cloud might seem like an odd way to end civilization, Shiel has an elaborate explanation for the cloud and its origin. In desolated London Adam finds old newspapers which outline the theories and debates his scientific peers had over the composition of the deadly volcanic gas. Professor Stanistreet argues that the cloud is

deadly because of carbon monoxide and carbon dioxide: “the destructiveness to life of the travelling cloud could only be owing to CO and CO_2” (*The Purple Cloud* 171). Dr. Martin Rogers disagrees, claiming that hydrogen cyanide is the killer. Adam believes the best argument comes from Slogget, of the Dublin Science and Art Department, who claims that potassic ferrocyanide is partially to blame “that its most active product must be, not CO, but potassic ferrocyanide (K_4FeCn_6), which, undergoing distillation with the products of sulphur in the heat of eruption, produced hydrocyanic acid (HCn)” (*The Purple Cloud* 171). Slogget argues that the particular chemical composition of the volcano was such that it included all the elements of potassium ferrocyanide. When the potassium ferrocyanide underwent “distillation with the products of sulphur in the heat of eruption” it created hydrogen cyanide. Then because the planet was warm enough in “all climates above a temperature of 26.5° C.” or seventy-eight degrees Fahrenheit, the hydrogen cyanide remained a gas and not a liquid thus killing everyone (*The Purple Cloud* 171). What Shiel outlines is all chemically possible: potassium ferrocyanide, in combination with an acid produces hydrogen cyanide, which is a gas above seventy-eight degrees Fahrenheit. Further, hydrogen cyanide is known for an almond-like odor. Therefore, a massive eruption of potassium ferrocyanide, with water and nitrogen, could in fact result in a hydrogen cyanide cloud that smelled like almonds.

The weak point in the scenario is that potassium ferrocyanide does not come from volcanoes. When Shiel was writing, potassium ferrocyanide was only available through manufacture: “This salt is manufactured on a large scale by heating refuse animal matter (waste leather, horns, hoofs, etc.) with potassium carbonate and iron (filings, etc.) The

fused mass is boiled with water, and from the solution thus formed the crystals separate on cooling" (Simon 389). Today potassium ferrocyanide is manufactured, not found. That being said, Shiel has rocks with the correct chemical components which could, when heated, hypothetically form the particular gas he claimed. The volcano from the novel is made up of "basalts, green-stone, trachytes, and the various porphyries" (*The Purple Cloud* 171). Basalt has both potassium and iron (Hatch 115). Green-stone is catch all that refers to rocks that have "feldspar, hornblende (or augite), and other minerals" in them ("greenstone, n."). And feldspar contains potassium (Hatch 26) and hornblende is made up of "silicate of iron" (Hatch 40). Trachyte is rich in feldspar and in "accessory minerals" such as "iron-ores" (Hatch 99). Porphyry, like green-stone, has a somewhat confused etymological history, but when Shiel was writing, porphyry could refer to "any igneous rock having a homogeneous groundmass in which larger crystals (phenocrysts) of one or more minerals (originally *spec.* of feldspar) are embedded" ("porphyry, n."). Hatch also claims that feldspar is an element of porphyry (Hatch 85). These rocks account for both the potassium, K, and the iron, Fe. The last piece of puzzle, cyanide, CN, is a combination of nitrogen and carbon, both of which are fairly abundant throughout the earth. So with the knowledge of the time, Shiel constructed a volcano that had all the ingredients required to create potassium ferrocyanide. And the instructions for the manufacture given by Simon, heat carbon and nitrogen with potassium and iron in water, would fit the eruption of a submarine volcano breaking through the ocean. While Shiel's particular vision could never occur given twenty-first century geologic knowledge, it was believable to audiences of a book published in 1901.

This fictional volcanic, chemical reaction demonstrates that Shiel was familiar with contemporary chemistry and geology. Adam notes that cyanide is product of "common distillation of pit-coal" (*The Purple Cloud* 172). The emission of cyanide from coal is mentioned in William Allen Miller's *Elements of Chemistry* (1857) "Cyanogen is also present in small quantity among the products obtained during the distillation of pit coal" (W. Miller 267). George Thomas Beilby develops and patents a technique in 1892 to produce cyanide "by passing ammonia over or through a liquid-fused mixture of anhydrous alkali and alkaline cyanide with finely-divided carbon" (Beilby 1). In essence by passing ammonia, along with a few other elements, over "charcoal, lamp-black, gas-black, coke or pitch, or any other convenient form" (Beilby 3) one could produce cyanide which was valuable for gold leaching. The knowledge Shiel displays through Adam is fairly specialized, suggesting Shiel had an above average understanding of chemistry. He was likely well versed; as Billings notes "Chemical experimentation proved to be one of Shiel's main interests throughout his life" (*M. P. Shiel: A Biography* 86). Contemporary readers would agree with Billings. Alden says that Shiel combined scientific realism and sensational plots: "His 'Purple cloud' was a scientific conception and it was full of 'shockers'" ("Mr. Alden's Views"). As Alden points out, Shiel incorporated a great deal of scientific knowledge into the novel. Shiel's knowledge of the chemical compositions of igneous rocks suggest that he likely had familiarity with geology, which is not surprising given the popularity of geology as a science in the nineteenth century.

1. Volcanoes and the Core of the Earth

Geology was one of the most exciting sciences of the nineteenth century. Thanks to both geologists and popularizers of geology the earth sciences were easily accessible for those who had the opportunity and the desire to learn. Recent scholarship has shown that geology was a popular field of natural philosophy, one that was easily taken up by non-professionals and hobbyists. Adelene Buckland argues that some nineteenth-century literature used geologic forms, and geologic work took narrative form (Buckland 275). Buckland follows this trend through the novels of Victorian authors like George Eliot and Charles Dickens, into the mid-nineteenth century. Around the middle of the century though, the discussion of geology shifts, as the ideas become more complex and the theory of evolution moves toward center stage. Thus Bulfin argues that Shiel knew Lyell and Cuvier because they were the largest figures of the uniformitarian and catastrophist camps respectively (Bulfin 159) before geology lost ground to evolution. Bulfin also connects Shiel with Alcide d'Orbigny who argued for the destructiveness of volcanoes (Bulfin 162). Shiel's understanding of theories of the earth are key to Bulfin's argument, as she says that Shiel drew upon the "geological theory and particularly the catastrophist vision of Cuvier to instantiate his particular version of the end of time" (Bulfin 167). But that knowledge was more than seventy years old by the time Shiel was writing; the field had advanced.

Unfortunately, after the mid-nineteenth century the ease with which geology was incorporated into broader culture declined. Ralph O'Connor argues that popularizers of

geology by the mid-nineteenth century were merely replicating previous geological narratives, whereas other mediums, like the visual arts, were advancing new ideas (O'Connor 435). O'Connor notes that after the 1850s "for new directions in the representation of earth history, we must turn to fiction – to the new genre of the scientific romance, as pioneered by Jules Verne, H.G. Wells, and Arthur Conan Doyle" (O'Connor 436-37) in addition to other genres to find geology at play in culture. After the eruption of Krakatoa there were fears that the planet was growing unstable. The geologist Edward Hull addresses this idea in the final chapter of *Volcanoes: Past and Present* (1892) which he titled "Are We Living in an Epoch of Special Volcanic Activity?" Hull states that many "might be disposed to give to the question an affirmative reply when we remember the eruptions of the last few years, and add to these the volcanic outbursts and earthquake shocks which history records" (Hull 253). Although Victorians were not living in era of increased volcanic activity, the reach of the British Empire and communication technologies made it seem like volcanoes were more active than in other periods. Shiel's novel is one of those scientific romances: he deploys volcanology, in conjunction with thermodynamics and chemistry, engaging with contemporary theories of geology and physics to tap into cultural fears about environmental instability. *The Purple Cloud* uses geology to help shape the form of the text, as volcanoes dictate the evolutionary and social progress of human life.

The novel foregrounds geologic formations. Early in the novel as Adam is heading south after the spread of the purple cloud, he lands on an island of Franz Josef Land, likely either Prince George Land or Alexandra Land. There he describes the

geology of his surroundings referencing the basalt that makes up that portion of the islands (*The Purple Cloud* 77). He even travels up a fjord to get a better look: "When I found a little fjord, I went up it to the end where stood a stretch of basalt columns, looking like a shattered temple of Antediluvians" (*The Purple Cloud* 78). Shiel's description is similar to Benjamin Leigh Smith's description of Prince George Land. Smith, an arctic explorer, was the first Briton to explore the island. His findings were announced in the *Proceedings of the Royal Geographical Society* in 1883 where C. R. Markham reported that "Near the ship was an old seabeach 90 feet above the level of the sea and cliffs of columnar basalt about 800 feet high" (Markham 205). Like Smith, Adam gets waylaid on Franz Josef Land and has to wait until the next summer before he can leave (Markham 207, *The Purple Cloud* 80). Of course, it is no surprise the Shiel might be looking into the accounts of Arctic explorers before writing a book about Arctic exploration. But in the popular press, there does not seem to be accounts that focus on the composition of the rocks on Prince George Land. Instead the reports focus on Smith's perseverance, how he and his party survived a full winter and then were rescued ("Epitome Of Opinion"). That Shiel chooses to focus the reader on basalt is intriguing, and he uses the term six times over only a few pages. Basalt is an extrusive igneous rock meaning that it generally comes from volcanoes. The reference to basalt is foreshadowing; some of the first rock that Adam sees before returning to England is volcanic rock. The novel's interest in geology and earth does not stop with a few references to basalt and one destructive volcano: the earth is a central topic of the novel.

The earth is one Adam's main focuses upon his return to the United Kingdom. After his initial searches fail, Adam realizes that people might have taken refuge in mines (*The Purple Cloud* 175). He assumes that people could have lived in the mines, avoiding the cyanide cloud, so he heads to the north of England. On the way north, Adam pauses between Flamborough and Bridlington to try and find any survivors. He moves along the seaside cliffs, which were "seventy feet high, broken by frequent slips in the upper stratum of clay, and, as I proceeded, climbing always, I encountered some rather formidable gullies in the chalk" (*The Purple Cloud* 179). The chalk and the clay stratum Adam describes are part of the Chalk Group, like the cliffs of Dover, which were deposited in the Cretaceous. These cliffs are famous for their fossils: dying organisms in the sea would just sink to the bottom and then be encased in the chalk. Adam encounters these ancient corpses as he searches for human survivors: "Here, I knew, I could meet only dead men, but urged by some curiosity, I searched to the end, wading in the middle through a three-feet depth of sea-weed twine: but there was no one; and only belemnites and fossils in the chalk" (*The Purple Cloud* 183). Shiel is vague on what 'fossils' are, but belemnites are cephalopods that were alive in the Cretaceous. Adam's encounter with the belemnites and fossils mirrors Henry Knight's encounter with the trilobite in *A Pair of Blue Eyes* (1873) by Thomas Hardy; in both texts ancient corpses highlight human mortality. Like the belemnite, the human bodies in *The Purple Cloud* will be covered up, compressed, and preserved for some future set of eyes. Adam's travels lead him to the regions of "iron-ore, alum, and jet-excavations round Whitby and Middlesborough" (*The Purple Cloud* 184), and he eventually visits mines all over the United Kingdom, which he

lists in some detail, including what they excavated: lead, graphite, cobalt, manganese, copper, coal, slate, or stone (*The Purple Cloud* 195-96). All he finds though are silent stones and the dead. Adam's explorations, juxtaposed with Cretaceous cephalopods, reinforce the geological situation of the humanity: a new mass of corpses to be fossilized. In *The Purple Cloud* humanity's trajectory is defined by terrestrial forces: consumed by rocks, killed by volcanic ash.

Volcanoes played an important role in Shiel's life. The island of Montserrat, where Shiel was born and lived the first part of his life, is volcanic. Montserrat sits on the edge of the Caribbean Plate. At the Caribbean Plate's eastern boundary, the South American Plate is being subducted creating the Lesser Antilles Volcanic Arc, which includes the volcanoes Soufrière Hills on Montserrat and Mount Pelée on Martinique. Howard Fergus, discussing the tendency towards disaster in literature from Monserrat, notes that Shiel was probably one of the first Montserratian writers to compose with the island's "awesome beauty" in mind (Fergus 22). Shiel himself was quite aware of his home's nature saying "Montserrat, a mountain-mass, loveliest of the lovely, but touchy! uncertain! Dashing into tantrums– hurricanes, earthquakes, brooks bubbling-hot, 'soufrières' (sulphur-swamps), floods– 'fit nurse to a poetic child', and I have seen 'unspeakable things, not possible for a man to utter'" (*Science, Life and Literature* 15). Shiel emphasizes the instability of the earth on Montserrat and its volcanic origins. He also connects himself with the literary and the religious by using quotations from the "Lay of the Last Minstrel" by Sir Walter Scott and chapter twelve, verse four of Second Corinthians. Regardless of how Shiel saw himself, he grew up on an island that was

geologically unstable. For Shiel the earth was not static; he knew so from experience. He even predicted "coming doom" for Montserrat (Shiel qtd. in Bulfin 163) when its volcano erupted. Soufrière Hills volcano did erupt 1995, and the southern half of Montserrat has been evacuated and is currently unoccupied since.

The Purple Cloud makes volcanoes a central feature of the plot, because for Shiel volcanoes were at the heart of any landmass as was the case on Montserrat. Shiel already believed that Montserrat's fate rested on the edge of the volcano (Shiel qtd. in Bulfin 163). The rest of the world, given strides in geological sciences that suggested uniformity in the earth's mechanism, would also seem to be on the edge of volcanic oblivion. Therefore, beyond the supervolcano that extinguishes almost all of the human race, the novel depicts other volcanoes and their effects on the world. Returning to his palace on Imbros after one of his world wanderings, Adam approaches the southern tip of Italy, "But when I came thereabouts, I was confronted with an awful horror: for no southern Italy was there, and no Sicily was there, unless a small new island, probably not five miles long, was Sicily; and nothing else I saw, save the still-smoking crater of Stromboli" (*The Purple Cloud* 268). What Adam describes appears to be the aftermath of the eruptions of Vesuvius and Etna, eruptions so massive they obliterated all of southern Italy including Naples (*The Purple Cloud* 269). A popular theory of volcanoes was that they were safety valves for the earth's energy (Sigurdsson 148). Stromboli is notable for frequent low energy eruptions (VEI one or two). The geophysicist, Robert Mallet speculated in "Mechanism of Stromboli" that were Stromboli ever not able to keep producing the minor eruptions then its next eruption would be "manifestly so great that it

would wholly change the character of the phenomena exhibited by the volcano" (Mallet 511). Mallet continues saying an eruption of such a size "must, during the last 2000 years, have produced a mass of ejected matter of enormous magnitude instead of the insignificant amount of mixed lava and debris which alone are to be seen" (Mallet 511) suggesting that Stromboli would destroy itself, or that the same might happen with Vesuvius or Etna. In *The Purple Cloud* this appears to be what happened, a massive explosion of volcanic energy erasing landforms from the map. In the nineteenth century there was precedent for volcanoes obliterating entire islands or landforms: Krakatoa.

Krakatoa is an important comparison for *The Purple Cloud*. Before Adam fully understands what has happened, he has an epiphany about the sunset: "one morning, a thought pricked me like a sword, for I suddenly remembered the great sun-sets of the later nineteenth century, witnessed in Europe, America, and, I believe, over the world, after the eruption of the volcano of Krakatoa" (*The Purple Cloud* 125). The atmospheric effects of Krakatoa are visible in a number of late nineteen-century paintings, like Degas's "Race Horses" and possibly Munch's "The Scream" (Oppenheimer 133). Shiel was eighteen when Krakatoa erupted, and would have been attending school in Jamaica, old enough to remember the brilliant sunsets that Krakatoa's eruption caused. He would have been able to read any of the newspaper reports on Krakatoa, which were widespread for even the pre-eruptions in May of 1883 (Winchester 197). Or Shiel could have learned of the destructive power of Krakatoa through *The Eruption of Krakatoa and Subsequent Phenomena* (1888) by Krakatoa Committee of the Royal Society. The Krakatoa Committee reports that "In the first place, we find that the whole of the northern and

lower portion of the Island of Krakatoa disappeared, with the exception of a bank of pumice and one small isolated rock about 10 yards square, which was left standing above the ocean with deep water all round it" (Krakatoa Committee of the Royal Society 22). The idea of an island volcano exploding, and "in essence disappearing" blasting "six cubic miles of rock […] out of existence" (Winchester 239) must have been unsettling to the young Shiel. For both Shiel and his readers such massive destruction, the obliteration of entire landforms, had precedent.

Like Adam, the academics in the novel quickly connect the eruption of the supervolcano with Krakatoa: "at a date so early Sloggett stated that the character of the devastation not only proved an eruption—another, but far greater Krakatoa—probably in some South Sea region" (*The Purple Cloud* 173). Given that two of the largest eruptions in modern human history, Tambora and Krakatoa, occurred only about nine-hundred miles away from each other in the Malay Archipelago, Sloggett's speculation seems reasonable. The cataclysmic eruption of Krakatoa would have echoed strongly in the mind of Shiel's readers, as Morgan notes "Shiel's first readers would have remembered a precedent for such a violent eruption" (Morgan 269). While the 1815 eruption of Tambora was certainly worse for Britain in terms of lives lost, Krakatoa was more well-known. As noted in the previous chapter, the reports from survivors near Krakatoa when it erupted described an infernal day that was black as night, filled with explosions, and a constant rain of hot ash and sand. Sloggett's conclusion that there had been an eruption even greater than Krakatoa, itself already massive, points to a fear that volcanoes were becoming unusually active toward the end of the nineteenth century. Hull in *Volcanoes:*

Past and Present even mentioned the eruption of Krakatoa in 1883 as potential evidence for increased volcanic activity; cases such a Krakatoa "might lead us to conclude that our epoch is one in which the subterranean volcanic forces had broken out with extraordinary energy" (Hull 253). *The Purple Cloud* tapped into this cultural concern that volcanic energy was on the rise, and that the planet itself might not remain habitable thanks to volcanism.

By using a volcano to highlight fears about a changing world, Shiel connects with the volcanic disaster narrative, which was in part pioneered by Bulwer-Lytton in *The Last Days of Pompeii*. Nicolas Daly charted the disaster narrative and how it moved between visual arts, the stage, and the novel in the early nineteenth century. Daly notes that volcanic narratives were particularly nihilistic because by the end of one everyone was dead "There is only annihilation, even for the virtuous" (Daly 280). Shiel's narrative follows this pattern with only two exceptions: Adam and Leda. Daly also notes that one of the pleasures of the volcanic disaster was the eruption itself: "the representation of the moment of destruction is still a significant component, and perhaps even offers greater pleasure for the spectator or reader" (Daly 280). The moment of destruction is notably absent in *The Purple Cloud* as Adam is alone in the Arctic when the eruption occurs. He does not witness the panic in the streets of London as the cloud pours through the lanes and into houses. The spectacle of mass dying is denied to the reader, although much of the book examines the remains of human civilization. The lack of the moment of destruction is important because in *The Purple Cloud* the eruption of the volcano is not the last event, but one of the first. The focus of the novel is not on the mass extinction of

humanity, but the way that the environment will shape the next iteration of human life. Returning to Edward Hull and the question of whether the late nineteenth-century world was in an "Epoch of Special Volcanic Activity" Hull's answer is no (Hull 256). But that he feels the need to address the question points to concerns about the dynamic nature of the planet, that the planet might be more fluid, more changing than previously thought. The volcanic eruption is not the climax of the novel, merely one part of an ongoing process of the "wide-spread re-arrangement of the earth's surface" (*The Purple Cloud* 269), a rearrangement that was inhospitable to the previous version of human life.

A little more than halfway through the novel, Adam considers the earth's dynamic nature, wondering about its structure and trajectory and whether or not he will be able to continue to live upon it. He begins the section with "The Earth is all on my brain" (*The Purple Cloud* 275) and ends it "more and more the earth over-grows me, wooes me, assimilates me; so that I ask myself this question: 'Must I not, in time, cease to be a man, and become a small earth, precisely her copy, extravagantly weird and fierce […] like her?" (*The Purple Cloud* 279-80). In the pages between, Adam considers a variety of geologic theories that explain features of the disaster that he has experienced. Volcanoes are one topic that Adam considers. He thinks to himself "Strange that volcanoes are all near the sea: I don't know why; I don't think that anyone ever knew" (*The Purple Cloud* 277). For Shiel this conclusion is obvious: he grew up on the Lesser Antilles Volcanic Arc, a collection of volcanic islands. Indonesia also seemed to be filled with volcanic islands, as did Sicily and Naples, and so on. Volcanoes and the edge of the ocean seemed intrinsically linked.

Shiel is not the first person to notice that volcanoes are distributed mainly along coast lines. The German Jesuit, Athanasius Kircher, drew one of the first maps that showed the distribution of volcanoes on the earth in 1665 (Sigurdsson 89). Mallet came to the same conclusion in 1858. One of Mallet's major contributions to geology was an in-depth catalogue of earthquakes throughout the world, including a map of their distribution. In his treatise, *The Earthquake Catalogue* (1858), which he co-wrote with his son, John William Mallet, Robert Mallet speculates about the mechanics of earthquakes and volcanoes. Like Adam, Mallet notes "our oceans and greater seas are bounded, and below their water surface subdivided, by these ridges, along the lines of which the volcanic foci are found; so, as long observed, it is a fact that all active volcanoes are comparatively close to the sea, or to some large body of water" (Mallet and Mallet 65). In apparent agreement with Mallet, Adam continues on considering volcanoes, noting that the nearness to the water supported the "chemical theory of volcanoes, which supposed the infiltration of the sea into ravines containing the materials which form the fuel of eruptions" (*The Purple Cloud* 277). The chemical theory was a favorite of Sir Humphrey Davy, who said "the quiet of a volcanic mountain after eruptions, the cessation and renovation of the effects in the same district, and the different intensity of the effects at different times, all point to chemical changes as the probable cause for these grand occurrences" (Davy 232). Adam is referring to the idea that volcanoes used water, which was part of Mallet's argument for Stromboli, and in fact, as far as early twenty-first geology is concerned, is true after a fashion (LeFemina 80). But the chemical theory of volcanoes, was under attack towards the end of the century.

Osmond Fisher, an English geophysicist, in his synthetic work, *Physics of the Earth's Crust* (1881) disputes Mallet's conclusions instead claiming that volcanoes erupt "by heat being transferred from some hotter neighbouring region" (Fisher 241) and thus Adam, in the soliloquy, states "but God knows if that is true" (*The Purple Cloud* 277) in regards to the chemical theory. Adam goes on to note that small volcanoes erupt more often but less disastrously, and that bigger volcanoes erupt less often but with great devastation. He also notes a bit later that volcanoes appear to form in lines "a linear system" (*The Purple Cloud* 277) again citing back to Mallet's maps of geologic activity and also Fisher, who also acknowledged that volcanoes occurred along lines "The linear arrangement of the greater number of the vents points to their situation along systems of fissures and represents on a grand scale the same phenomenon which occurs when subsidiary cones of eruption are established upon fissures radiating from a central volcano" (Fisher 259). Fisher's theory instead relies on constant heat source within the planet and some plasticity within part of the planet's composition, so that water infiltrates the fissures he references above, which then allows for melting and lava production. Fisher's theories resemble the now agreed upon theory of plate tectonics and the subduction of plates as a cause for volcanism (LeFemina 80). Mallet's and Fisher's theories see the earth as more plastic and made up of causally linked systems. Shiel demonstrates this kind of systematic view of volcanoes transferring geological speculation into a fictional text. An igneous system would suggest a dynamic planet, as the linkages between volcanoes and other features of the earth formed a causal chain.

Noticing the unequal distribution of land between the northern and the southern hemisphere, Adam wonders: "The preponderance of land in the northern hemisphere denotes the greater intensity there of the causes of elevation at a remote geologic epoch: that is all that one can say about it: but whence that greater intensity?" (*The Purple Cloud* 278). Adam suggests that North America, Europe, and Asia were the result of greater geologic energy in the distant past. His statement contradicts the dominant theory that the world was contracting "The concept of global contraction from one or more causes – cooling, compaction, or the extrusion of magmas and water from the interior – dominated geological thought through the 19th and much of the 20th centuries" (Marvin 39). Contraction did not allow for elevation, at least not of mountains (volcanoes were the exception). According to contraction theories, the earth started as molten ball, cooled, and had been cooling since then. Uplift was not a possibility. Adam is staking out a position between the uniformitarian camp and another more radical camp of drift theorists. Adam's position is not uniformitarian per se because of the idea of "greater intensity" is contrary to the uniformitarian doctrine of the equality of geologic forces throughout time. Adam's question is much more catastrophist in its phrasing: that at some point there was a great uplift. What is different is that Adam is looking globally, rather than the more localized focus of catastrophists. This statement puts Adam in a more radical camp that believed that the earth down to its core were in a state of flux.

Adam continues his questioning by considering the very core of the planet: "I have some knowledge of the earth for only ten miles down: but she has eight thousand miles: and whether through all that depth she is flame or fluid, hard or soft, I do not

know" (*The Purple Cloud* 278). The nature of the center of the earth was still contested at the end of the nineteenth century. Theories suggested that there was a "thin solid crust […] surrounding a hot liquid interior" (Brush 226) or a "solid shell, liquid interior, gaseous center" (Brush 228), in addition to at least four other models. Each of these models attempted to explain one kind of evidence, like temperature and thermal decay or the uplift of mountains. Adam's confusion stems from conflicting geological and thermodynamic data. Fisher in *Physics of the Earth's Crust* also calculates that the crust's "thickness is there [under the oceans] about 20 miles; while, in the continental areas, its density is about 2·68, and its thickness at the sea level about 25 miles" (Fisher 282). Fisher's calculations about continental crust are roughly correct, the current estimate is between twenty and thirty miles thick; oceanic crust is far thinner, though, only about six miles thick. Fisher's description matches the thickness that Adam postulates. Fisher also postulates a liquid center to the earth: "If we admit that the cooled crust of the earth rests upon a fluid substratum, we cannot doubt that the fluidity is a consequence of its high temperature; and it probably follows that volcanic eruptions arise from emanations from the substratum gaining access to the surface" (Fisher 275). Fisher argues that because of the liquidity of the core, the crust might move over it, either causing or caused by volcanic eruptions. The debate around the core of the earth did subside until about 1936 when there was a more or less complete understanding of the interior of the earth (Brush 252). Adam's speculation about the core of the earth reinforces the fluid nature of the ground that he stands upon. All of Adam's thoughts touch on geological debates of the late nineteenth century. Scientists were attempting to explain the mechanisms of the earth

and its frequent changes with new data and methods. Their explanations increasingly pointed to the idea that the earth was in constant movement. These scientific speculations, in addition to the increased volcanic reports, would suggest as Hull considers, that the world is in a state of increased volcanic activity. Victorian culture was increasingly concerned with change, whether that was cultural through globalization, evolutionary through degeneration, or environmental through the increasing evidence that the earth was more dynamic than had been previously thought.

2. Continental Drift

Adam's earth soliloquy starts off with the most dynamic idea of the age, that the continents of the earth were not static. As he is thinking about the planet Adam considers earth's vast history, and how the shapes of the continents fit together:

> Often a whole night through I lie open-eyed in the dark, with bursting brain, thinking of that hollow Gulf of Mexico, how identical in shape and size with the protuberance of Africa just opposite, and how the protuberance of the Venezuelan and Brazilian coast fits in with the in-curve of Africa: so that it is obvious to me—it is quite *obvious*—that they once were one; and one night rushed so far apart; and the wild Atlantic knew that thing, and ran gladly, hasting in between: and how if eye of flesh had been there to see, and ear to hear that cruel thundering, my God, my God—what horror! (*The Purple Cloud* 276)

The passage considers the idea that the continents, like Africa and South America here, could move or be moved, in other words continental drift. The horror that Adam refers to is two-fold. First, what it would have been like to witness such an event, the cataclysmic reshaping of the surface of the planet, the rushing and the thunder as the earth was rent

apart. The second feature of the horror is the readjustment of the time scale, as millions of years of slow movement were compressed into one terrifying night so that a human being might view the change. Adam is considering the dynamic nature that the earth has already exhibited with the volcanic eruptions earlier, which suggests a world in flux that cares little for human life; a world where people are merely hanging on. The scientist that is credited with the discovery of continental drift, Alfred Wegner, was alive in 1901, but would not publish his theories until 1912. Wegner is not the only person who speculated on the movement of the continents. Fisher thought that because the center of the earth was still liquid, the crust of the earth was heated and plastic and could drift (Fisher 275). Throughout the latter half of the nineteenth century a number of professionals and amateurs offered up theories of continental drift.

The paradigm shift in geology in the early nineteenth century started to show that the earth was constantly changing and shifting. Those who studied geology, roughly, broke into two camps, the catastrophist and uniformitarian camps, mentioned earlier. By the mid-century these camps were wrestling with a new problem: the Alps (Le Grand 24). Neither catastrophists' nor uniformitarians' theories allow for much movement of the Earth: they focus instead on erosion of the Earth and the replacement of material via flooding, volcanoes, and earthquakes. The central question for these theories is time and intensity. The earth could move in these theories but not by much. Lyell and Cuvier along with other geologists helped create the foundation that would allow for the movement of the earth. In the late nineteenth century, debate focused on the manner or direction of that movement: either the continents always existed or the earth was contracting, revealing

shapes from under the oceans (Le Grand 1). The Alps were a problem because of their origin. The mountain range was caused by the collision of the African and Eurasian plates in the Cretaceous: the extreme stress and compression between the two plates caused the folding and layering that so perplexed geologists at the time. Homer Le Grand states that the uniformitarian argument "held little appeal: how could the Alps possibly be explained by very slow elevation through earthquakes and volcanic action?" (Le Grand 24). A variety of theories responded to try and make sense of the Alps. Permanentists argued that the world had always been the same shape since the beginning, with minor changes over time (Le Grand 21). Contractionists claimed that geological features developed as the earth cooled and shrunk over time, which caused the crust to be "wrinkled, folded and subsided" (Le Grand 25). Drift theorists thought that the continents had moved or shifted in some fashion, but were not in agreement as to how or why (Le Grand 28). A diverse group of professional, academic, amateur geologists and non-geologists pursued the question attempting to learn if the earth had ever changed radically in the past. Given Shiel's passage, there were a few of these thinkers that were important in the development of *The Purple Cloud*.

One of the lesser known theorists of continental drift is Antonio Snider-Pellegrini (1802-1885), a French scientist. He argued for a version of continental drift in his book *La Création et ses Mystères Dévoilés* [The Creation and its Mysteries Revealed] (1858). Snider-Pellegrini's argument cited both the Bible and the worldwide distribution of coal to claim that the earth had at one point been united and was then broken apart. While his theory was revolutionary, perhaps what is better remembered of Snider-Pellegrini is a

pair of engravings he made which depict the continents together and then subsequently apart. Snider-Pellegrini described his engravings thus:

> La première, marquée 9, ou *avant la séparation*, montre notre planète à l'époque de l'intervalle, c'est-à-dire depuis Adam jusqu'à Noé, lorsque la terre n'était encore qu'un bloc, sillonné à la surface par des crevasses. Dans cette période figure la masse atlantide, qui devait plus tard laisser sa place à un ocean. La seconde gravure, marquée 10, ou *après la séparation*, représente ce même globe avec l'écartement de ses parties à la surface, après le déluge, c'est-à-dire depuis Noé, et tel qu'il existe de nos jours. (Snider-Pellegrini 314)
>
> [The first figure, marked 9, or *before separation*, shows our planet at the time of the gap, that is to say, after Adam but before Noah, when the earth was still a block, the surface furrowed with cracks. This period includes the Atlantis mass, which later gives way to the ocean. The second engraving, marked 10, or *after separation,* is the same globe with the separation of its parts on the surface after the Flood, that is to say, since Noah, and as it exists today].

Le Grand notes that Snider-Pellegrini did not make any waves with the theory that the Noachian Flood had rent the continents apart: "His theory attracted little attention though his maps depicting the joined continents were reprinted in a popular English introduction to geology" (Le Grand 29). The book that Le Grand is referring to is John H. Pepper's *The Playbook of Metals* (1861). While Snider-Pellegrini's book might not have attracted much attention, Pepper's book probably did, albeit not from an adult audience.

An advertisement in *The Observer* announces the publication Pepper's book as a "new boy's book" and emphasizes how the books connects to "Alchemy and the Chemistry of the Fifty Metallic Elements" ("Classified Ad 1 -- no Title" 9 Dec 1860). About two decades later, Pepper's book was also on a list of Christmas gift books recommended by Macmillan and Company ("Christmas Gift Books"). The book was also a frequent prize for school contests ("Multiple News Items" 21 June 1873, "Guildhall

Commercial School," "Worcester Grammar School"). In the second sentence of the book Pepper pauses to say to his young audience "the personal narratives of those visits [to mines] may be of service to the youthful reader who may be stimulated to go over the same ground" (Pepper 1). The first sentence of the first chapter also mentions the youthful reader (Pepper 3). *The Playbook of Metals* wanted to help boys understand and use chemistry, especially in regards to metals. It would not be surprising if a young man, interested in chemistry, happened across a copy during his education. Given Shiel's acknowledged interest in chemistry and *The Playbook of Metals*'s connection between geology and chemistry, it is possible to imagine the young Shiel reading the book. There he could have looked at the engravings and read Pepper's synopsis of Snider-Pellegrini's engravings,

> which are intended to show the alteration of the relative positions of land and water on the surface of the globe since its creation […] M. Snider supposes the earth to have been one continuous block or mass rising out of the ocean, and the space marked the Atlantide (the Atlantic) to have been formerly dry land, but now changed to the bed of the mighty Atlantic Ocean. (Pepper 9)

Pepper's synopsis does not suggest the radical change that Snider-Pellegrini engravings do. The summary says that the Atlantic Ocean sunk at one point, rather than Snider-Pellegrini's more violent wrenching of the continents. Pepper does not just present Snider-Pellegrini's ideas and then move on, though. Instead Pepper constructs an argument for continental drift based on additional evidence.

The first chapter of *The Playbook of Metals* focuses on coal, its uses and locations. Pepper's chapter is exhaustive going from the origin of coal, to its locations, how it is mined, and finally to its use in the fireplace. Pepper starts with the beginnings of

coal. He tells his young reader that "this mineral fuel is the remains of vast forests, and other large growths of innumerable plants, which have lived, died, and have been entombed by the all-merciful hand of Providence thousands of years ago, and are now being exhumed for our benefit to give us health" (Pepper 5). Coal is the product of wetland forests that were buried and then pressurized, which for Pepper and some other nineteenth-century scientists was the act of a benevolent God. Pepper goes on to describe the mechanism for coal creation, which he states is a product of "drift" (Pepper 6). Drift here though does not mean continental drift but instead the erosion of land and forests. The eroded material would drift, through water, and cover parts of Great Britain in the dead vegetation required to create coal. In other words, Pepper believed that materials were drifted around a static globe and deposited, instead of the land moving. The theory worked because the ancient world, as Snider-Pellegrini claimed, was united and covered in crevasses. These crevasses drained the plant material north and south. As Pepper says "The once familiar 'Drift' theory which accounted for the production of our British coal, supposed that vast forests were swept from the land into the arms of the mighty ocean or into vast lakes, by continual inundations or powerful streams" (Pepper 6). At that time the shape of the land was different so that "The Northern Ocean, at the commencement of the coal period, was, it is supposed, divided into basins, varied by islands, bounded by shores, supplied by inundations from extended land" (Pepper 8). The divided basins explains why some places in England had coal and others did not. In the interest of helping the young reader understand the various sides of the issue, Pepper also brings up "submergence" theory the opposite of "drift" theory.

Pepper cites arguments made by G. F. Richardson about why vegetation was not swept away by floods and deposited in Britain. Richardson, paraphrased by Pepper, notes that "The multiplied instances of trees found erect establish the fact of the coal plants having chiefly grown on the spot where they are now entombed" (Pepper 12). The plants grew, died, and were pressurized in the same place, which means that the climate of prehistoric Britain must have been drastically different. Pepper then cites Evan Hopkins, who claims that the landmasses might move around the planet "by the mechanically-destructive and chemically-solvent power of water, aided by electro-chemical currents and crystallization" (Pepper 12). Hopkins' theory is that electrified water might allow continental landmasses to float around the world and collide. Hopkin's mechanism allows for the potential movement of landmasses, causing Pepper to conclude "Hence it is urged that formerly England was differently placed, and enjoyed a tropical warmer climate; and during that period the coal-plants grew and expanded into those gigantic proportions which seem to be the speciality *[sic]* of the flora of the coal-measures" (Pepper 13). The theories that Pepper outlines and their pieces form a version of continental drift. Regardless of correctness of the theories, Pepper offers the possibility of the movement of continents, either through the sundering of South America from Africa or the possibility of the British Isles ranging freely across the oceans. Given the descriptions available in Pepper's book, it is easy to see a young Shiel reading Pepper's work and using the images to compose a version of continental drift where South America and Africa "one night rushed so far apart; and the wild Atlantic knew that thing, and ran gladly, hasting in between: and how if eye of flesh had been there to see, and ear to hear

that cruel thundering" (*The Purple Cloud* 276). The shifting of the continents means that the earth is alive, not a solid, shrinking mass. While there is no continental drift in the novel itself, the possibility of moving continents helps reinforce Adam's suspicious that the world is being rearranged beneath his own feet. A shifting, dynamic earth means that Adam's environment is as vibrant as it inhabitants.

Adam ends the soliloquy by reflecting on how he is turning into the earth, saying that perhaps he will become a small version of the planet. The simile cuts both ways though: not only does Adam think he might become like the earth, but he also speculates that the earth is like him. In one section Adam asks "Is she herself a living being, with a will and a fate, as sailors said that ships were living entities?" (*The Purple Cloud* 276). Adam is combining the dynamism of the planet with the dynamism of life. The soliloquy is not the first time Adam has considered the planet to be alive, either. Early in the novel, at the North Pole, Adam encounters cyclopean, inhuman architecture. After walking through fields of "jewelled meteor-stones" worth "trillions of billions" (*The Purple Cloud* 65) Adam comes upon a lake. The lake is about a mile across, and in the center there is "low and broad" pillar of ice (*The Purple Cloud* 70). Adam believes he sees a name or a word engraved onto the pillar written in characters that he cannot comprehend, and under that name a date. As he watches the liquid in the lake, Adam comes to an unnerving realization "the fluid of the lake seemed to me to be wheeling with a shivering ecstasy, splashing and fluttering, round the pillar, always from west to east, in the direction of the spinning of the earth; and it was borne in upon me—I can't at all say how—that this fluid was the substance of a living creature" (*The Purple Cloud* 70). Noticeably, Adam does

not describe the fluid as water, the typical substance that fills lakes. The implication is that the fluid is a more organic humor. Adam suspects that the fluid is part of a "creature with many dull and anguished eyes" and that the creature was wheeling around the structure, its eyes on the name and date on the pillar (*The Purple Cloud* 70). Then Adam passes out. There is the implication that Adam's arrival at the North Pole, at this strange lake, is what sets off the supervolcano and causes the end of the human race in the novel.

As Adam says very early in the novel, "there was undoubtedly some sort of Fate, or Doom, connected with the Poles of the earth in reference to the human race: that man's continued failure, in spite of continual efforts, to reach them, abundantly and super-abundantly proved this" (*The Purple Cloud* 17). The novel seems to entertain that idea, although there is not much that truly connects the North Pole and human extinction besides the correlation in timing. Adam's glimpse of this creature, which seems to be the earth, helps reinforce the connections between people and the planet as living fluid creatures. The connection between the human being and the planet, though, means that they can suffer from similar ailments. In the soliloquy Adam suspects a "sinister coming doom" (*The Purple Cloud* 275) for the planet. Adam is not alone in his fears for the planet. Edward Hull believed that the earth was running out of fuel: "volcanic energy has well-nigh exhausted itself over these tracts of the earth's surface" (Hull 256). If the volcanoes themselves seemed to be waning in power and energy, then the rest of the planet was too. And if the earth is moving, as Snider-Pellegrini and Fisher claim, then it must have energy. As the recently defined second law of thermodynamics stated, all energy would eventually waste away to entropy.

3. Regeneration of the Earth and Humanity

Adam's concern about the energy of the earth grows through the novel. Early on, when Adam is a bit more optimistic about the fate of the world he claims "with this exception [plant life], all life, down to the lowest evolutionary forms, would disappear (here was the one point in which he was somewhat at fault), until the earth reproduced them" (*The Purple Cloud* 174). At that time, Adam believes that the earth has the capacity to create or generate life. Later though, during Adam's pyromania, he is less sanguine about the fate of the world as a whole. In an early conversation with Leda (whom he calls Clodagh here after his wife) Adam states that the Earth has run out of the energy necessary to produce humanity:

> But I *told* you, didn't I, that no more men will spring? You understand, Clodagh, that originally the earth produced men by a long process, beginning with a very low type of creature, and continually developing it, until at last a man stood up. But that can never happen again: for the earth is old, old, and has lost her producing vigour now. So talk no more of men *splinging*, and of things which you do not understand. (*The Purple Cloud* 393)

The capacity to generate more life is predicated upon having enough energy to do so, which Adam feels is unlikely. Adam suggests that to create more humanity the earth would need to evolve human beings from scratch. But the earth lacks the energy to do so. His concerns are similar to a few scientists at the end of the nineteenth century. The Contractionist geologists, led by Edward Suess and his treatise *Das Antlitz der Erde* [The Face of the Earth] (1883-1904), argued that the Earth was cooling, and thus contracting

slowly (Oreskes 10), which meant that the earth was losing energy. These theories were supported by work in the developing field of thermodynamics, such as William Thomson's, Lord Kelvin's article "On the Secular Cooling of the Earth" (1862). In the article Kelvin criticizes uniformitarian geology (Kelvin 298). Using a variety of calculations focused on rates of cooling, Kelvin demonstrates that the earth might have had a liquid subsurface, but that surface is now almost completely cool: "it is probable that when the whole globe, or some very thick superficial layer of it, still liquid or viscid, has cooled down to near its temperature of perfect solidification, incrustation at the surface must commence" (Kelvin 310). Kelvin was a pessimist, having determined that the Sun would go extinct in the future thanks to a diminishing supply of new fuel energy. The Second Law of Thermodynamics argued that "the solar system being a closed system, the eventual heat-death of the sun and the consequent total extinction of all life on earth was a scientific certainty" (Jones 180). Darryl Jones notes that "the cultural resonances of the Second Law of Thermodynamics for the nineteenth century were, understandably, profound, and in some cases unbearable in their apocalypticism" (Jones 182). If, as Kelvin and Suess argued, the Earth was cooling, if not already completely cool, then civilization's remaining time on the planet would seem to be quite short as the earth ran out of the energy necessary to support human life.

Of course, in *The Purple Cloud* civilization is extinct, a result of this entropy. As Adam proclaims in the quotation above, the earth does not have enough energy to regenerate or recreate human life. He has ample evidence for that: the explosion of the supervolcano in the South Pacific, the destruction of southern Italy, the storms throughout

England, and ones in the Pacific; the Earth was bleeding energy, perhaps in its own death throes. Earlier in the novel, Adam speculates that human beings have had a calming effect on the Earth: "it would seem that the mere presence of man had a certain subduing or mesmerising effect upon the native turbulence of Nature, and his absence now may have removed the curb" (*The Purple Cloud* 274). Adam's view is anthropocentric, but it follows a geological argument that the forces of nature have weakened as humanity has advanced. As Kelvin explains "geological speculations assuming somewhat greater extremes of heat, more violent storms and floods, more luxuriant vegetation, and hardier and coarser-grained plants and animals, in remote antiquity, are more probable than those of the extreme quietist, or 'uniformitarian,' school" (Kelvin 296). The rationale, in Kelvin's argument, was that there was more energy in the past, thus more vibrancy and violence. Adam claims that the storms are back. The reason for the return is unclear, whether the storms were the result of the polar journey, the supervolcano's eruption, the absence of society, or the cooling of the Earth; they do signal the wasting of earth's energy. Therefore Adam believes that the Earth's energy is waning, given all the evidence he has of massive energy expenditures. Or, at least he believes this until late in the novel.

As Adam is travelling north with Leda, away from Imbros and back towards England, he recalculates the remaining energy of the Earth: "It was wonderful to see the villages and towns going back to the earth, already invaded by vegetation, and hardly any longer breaking the continuity of pure Nature, the town now as much the country as the country, and that which is not-Man becoming all in all with a certain *furore* of vigour"

(*The Purple Cloud* 405). The colonization of human spaces with plants indicates to Adam that the world might have some energy left. Importantly, the word "vigour" is used here, which appears only four times in the novel: to describe Adam's mania for palace building (*The Purple Cloud* 260), as an adjective for Leda's memory and intelligence because she learns so quickly (*The Purple Cloud* 352), for the earth in the waning sense from earlier (*The Purple Cloud* 393), and then here for the waxing power of the earth. Shiel returns to that word because it is one of his defaults when it comes to describing energy, instead of "energy" itself which he only uses once (*The Purple Cloud* 153). The earth does have the energy it needs to continue to support life, just not life in the same shape as Adam expected. While human beings often perceive disasters and extinctions as bad, because they are destructive, in reality these dynamic changes offer new apertures for growth and life. Humanity's existence is predicated on the space vacated by so many previous species. In the reclamation of the village, Adam sees the continued vitality of the earth suggesting that all energy is not gone.

Not all geologists were pessimistic about what massive movements of the earth meant. Mallet concluded his discussion of earthquakes and volcanoes on a more hopeful note. He said that the earthquake's true function "is part of the dislocating, degrading, and levelling machinery of the *surface* of our globe, while the part of the volcano is restoration and renewal. Both are, however, not creative but conservative (strange as it may sound), and suited to the period of man's appearance and possession of the earth" (Mallet and Mallet 71). The Mallets do not elaborate on what they mean by "suited," but presumably they are referring to the same anthropocentric concept that Adam mentioned

about fierce storms diminishing as human civilization grew. The idea is that the environment is formed for human life. The Mallets are not wrong, although they have the causality reversed as human societies are formed to the environment. Still, they propose an interesting idea: that these two massive, earth-shaping phenomena are not part of the degradation of the planet, but instead part of the conservation of the planet. The Mallets are correct because both earthquakes and volcanoes are essential parts of the rock cycle. And both earthquakes and volcanoes are products of plate tectonics. Thus when Adam considers the "wide-spread re-arrangement of the earth's surface" (*The Purple Cloud* 269) what he is referring to is the rejuvenation of the planet, not the degradation. Shiel is proposing a more optimistic conception of the future for the earth and its inhabitants. That being said, many have read Shiel's novel as only pessimistic, an apocalypse and the end of the human race.

H. G. Wells considers *The Purple Cloud* to be a gloomy-but-possible forecast for society. In an article for *The New York Times* Wells speculates on the future of the earth. He sees Shiel's novel going in the opposite direction as human civilization, towards extinction rather than growth. Wells argues that society has a bright future. He concedes that the human species could face extinction from an extraterrestrial force: "It is conceivable, for example, that some great unexpected mass of matter should presently rush upon us out of space, whirl sun and planets aside like dead leaves before the breeze and collide with and utterly destroy every spark of life upon this earth" (Wells). Wells references Shiel because of Shiel's vision of the end of the human species in *The Purple Cloud*. Wells says that "no one can dispute that some great disease of the atmosphere,

some trailing cometary poison, some great emanation of vapor from the interior of the earth, such as Mr. Shiel has made a brilliant use of in his 'Purple Cloud' is consistent with every demonstrated fact in the world" (Wells). According to Wells the potential for human extinction exists, and Shiel did an excellent job of demonstrating that. Wells' vectors for extinction are possible: disease, an impact event, or supervolcanic eruption. But Wells himself does not see human extinction as a possibility: "And yet one doesn't believe it. At least I do not" (Wells). He believes that human beings will outlast because "the greatest change that humanity has ever undergone" (Wells) is about to occur. The article does not offer a particular change, besides more knowledge and increased order, but through these Wells sees a bright future for human society. Unfortunately for Wells' claim, World War I was only nine months away. Further, Wells misreads *The Purple Cloud*; Shiel's novel is quite explicit about the return of human life. Shiel is as optimistic as Wells in regards to what human beings might expect from future life on earth. Despite Wells referencing the destruction of the human species in *The Purple Cloud*, the human race is not destroyed but, arguably, grows stronger because of Leda's seduction of Adam.

Adam at the very end of the novel describes the new humanity. He says that they will be like their "Mother: nimble-witted, light-minded, pious—like her; all-human, ambidextrous, ambicephalous, two-eyed—like her; and if, like her, they talk the English language with all the r's turned into l's" and further "They will be vegetable-eaters […]: for they will be her sons, and she, to the furthest cycle in which the female human mind is permitted to orbit, is, I swear, all-wise" (*The Purple Cloud* 462). Minus the misogyny about the orbit of the female mind because of Shiel's retrograde views on women (*M. P.*

Shiel: A Biography 40), Adam lays out an evolutionary trajectory that is arguably desirable as human beings change to be smarter, more flexible, and vegetarians. Svitavsky argues that the improvement of human race through combination East and West is one of the main themes of the novel. Stableford says that Shiel had faith in evolution and progressiveness which points towards an optimistic ending for *The Purple Cloud* (Stableford 83). Billings claims that Shiel saw human evolution trending towards a homogeneity of races; that Shiel hoped for a superior human species that was unified "He saw the 'overman' as a development of the entire human race accomplished through better educational systems and a more scientific bend of mind, not for a single 'overman' race against other races, but for all humankind" (*M. P. Shiel: A Biography* 42). *The Purple Cloud* ends in a hopeful manner, with a new human beings that are a racial blend which will be brought up with a multifaceted education, given the natural intelligence of Leda, her piousness, and Adam's capabilities with medicine and science. All of these changes are the product of an extinction-level volcanic eruption, altering human society for the better.

Unlike other narratives of human evolution, where human evolution is controlled or modified by culture or society like *The Time Machine* (1895), Shiel's novel gives the Earth primary control in human advancement. The supervolcano in the South Pacific causes a mass extinction event radically altering the shape of human development. Vegetarianism is a choice that human beings can make in industrial societies. Leda's children do not get that choice though; thanks to the supervolcano "all life, down to the lowest evolutionary forms, would disappear" (*The Purple Cloud* 174). Enforced

vegetarianism would not necessarily be a negative change. James Gregory notes that Victorian vegetarians promoted "vegetarianism as part of their religious beliefs, hygienic reform or utopian experiments" (Gregory 2). The practice of abstaining from meat was related to faith, health, and ideal living. Vegetarian publications claimed as much, saying that their diet was "'favourable to health, peace, and happiness, and has a tendency to abolish everything that makes us miserable in this world'" (*The Truth-Tester* qtd. in Gregory 1). The supervolcano has, assuming that vegetarians are correct, created a society that in dietary practice will be more utopian than the degenerate society that Adam came from. But the eruption does not merely restrict the diet of this new human race. The supervolcano also restricts the genetic diversity of humanity, causing the new race to develop new dominant features.

Two of the traits Adam identifies are ambidexterity and ambicephalous. Ambidexterity was not universally thought of as good. Like left-handedness there was some stigma against people who used both hands. Havelock Ellis claimed that there were a higher percentage of criminals who were left-handed and ambidextrous than right-handed (H. Ellis 108). He also commented that "It is also interesting to note the ambidextrous tendency among children, savages, and idiots" (H. Ellis 109). But Ellis's opinion was only one. The editors of the *Journal of Hygiene and Herald of Health* argued that "Those who are ambidextrous may not be twice as capable as those who can use only one hand readily, but they certainly must have greater capacity. For this reason, if for no other, cultivate ambidexterity" ("Notes Concerning Health" 97). Contemporary opinions on ambidexterity were mixed, although there was support for ambidexterity as

advantageous. What Adam means by "ambicephalous" is a bit unclear. Bicephalous would mean that his offspring have two heads. Adam says that his children will have two eyes, suggesting that they will also have just one head. More likely, Adam believes that the children will be able to use both hemispheres of their brain equally, which is in accordance with his belief that the children will be ambidextrous. Both Paul Broca and Karl Wernicke by this time had completed their researches on the brain and its hemispheres. The same article on ambidexterity, also has a reference to the hemispheres of the brain: "Training the left arm to be as efficient as the right at the same time educates the right side of the brain. This side controls mainly the left side of the body, and *vice-versa*" ("Notes Concerning Health" 97). These new human beings, then, would be more flexible in thought and body, presumably capable of better utilizing their brains and hands than earlier humans. The other features of Leda, her intelligence, wit, and piety would only further benefit this new race.

Adam largely excuses himself from the children's future, seeming to say between the lines that his genetics and skills will somehow not have an impact on them. Regardless, his skills, knowledge of science, medicine, and engineering would no doubt be of use to his children, further benefitting the new race. The last action that Adam does take in the novel is to decree that "That the one Motto and Watch-word essentially proper to each human individual, and to the whole Race of Man, as distinct from other races in heaven or in earth, was always, and remains, even this: 'Though He slay me, yet will I trust in Him'" (*The Purple Cloud* 463). Adam gives the last word of the novel to Job, who says that while God might kill him, he will still trust God and keep God's ways

(*King James*, Job 13:15). Stableford notes that *The Purple Cloud* is a combination of Genesis and Job but it is "by no means Christian" (Stableford 77). Shiel was religious, although in his own fashion. As Bulfin notes "Shiel had come to understand God as a powerful force for change in the world — change that is both purposeful and progressive" (Bulfin 172). Giving the last line to Job reinforces an idea of determinism, as Job's fate is determined by God. Adam's, Leda's, and their children's fates are determined by the volcanoes and the living planet. The evolution and growth of the human species is connected to changes in the earth.

Shiel is not the only writer to note the power of volcanoes to shape humanity. The geologist, Archibald Geikie starts out his work *The Ancient Volcanoes of Great Britain* (1897) with a brief paragraph about the impact of the environment on humankind "Among the influences which affected the infancy of mankind, the most potent were those of the environment. Whatever in outer nature stimulated or repressed courage, inventiveness, endurance, whatever tended to harden or weaken the bodily faculties, whatever appealed to the imagination or excited the fancy, became a powerful factor in human development" (Geikie 1). Like Shiel, Geikie notes that the environment has a particular impact upon humankind. Geikie goes on to say the volcanoes must have changed early human beings, especially shaping their conceptions of the world. Shiel has taken Geikie's formulation an applied it to the future.

In *The Purple Cloud* the world is a complex system of interlinked phenomena, where energy reshapes the surface, causing some life to vanish and other life to thrive. Shiel has in essence, as show above through his usage of geologic theories combined

with evolution, written the first environmental catastrophe novel, one that uses a geologic force to reshape society. He does not end the human world, he restarts it: he recognizes the environmental impact on life and uses that as a platform to create a better human race at the end of the novel; volcanoes and continental drift determine who or what the human being is. The novel shows how human beings are both subject to the environment, yet also benefit from the environment. *The Purple Cloud* along with other geologic texts demonstrate that human civilization is just another actor in the environment, which both acts and is acted upon by ecological forces establishing a series of networks between the movement of the earth, volcanoes, and humanity.

CONCLUSION

After a century of consideration volcanoes were on the edge of being fully integrated into a planetary system, as can be seen in the progress from Hamilton to Shiel. Thanks to the ontological work done by a range of thinkers and writers volcanoes were becoming more intelligible despite their non-locality, viscosity, and interobjectivity. Work of this nature was multisided: it was not enough that Hamilton and Piozzi saw the depths of time that volcanoes occupied, without Lyell and Bulwer-Lytton to help remove the symbolic meanings attached to volcanoes. Wakefield's and Gordon-Cumming's accounts brought volcanic experiences to a larger audience, but synthetic works like Shiel's brought volcanoes into a world system. The writers and texts gathered here are not *the* texts by which developments in volcanic thinking occurred, but rather gauges where the changes can be seen as they moved through society. The changes were substantial, as volcanoes moved from being perceived as individual and unique, to being part of an igneous network. One might assume then that volcanoes would be completely integrated into a planetary system at the beginning of the twentieth century. Surprisingly there was a six-decade gap before volcanism was united with a planetary system. The cause of this gap was a failure of both interdisciplinary and ontological thinking. While volcanoes are only a piece of the puzzle, their incorporation into the planetary system is the key that transforms continental drift into plate tectonics. As a brief conclusion, this dissertation will address the connections between volcanoes and continental drift as an example of how easy it is to challenge systematic thinking about hyperobjects. While volcanoes are eventually included in a global geologic network, there is a sixty-year gap

in the twentieth century between Shiel's novel and the eventual scientific inclusion of volcanoes in the planetary system.

Haraldur Sigurdsson notes in his history of volcanology, on the penultimate page, that it was only in the 1960s that volcanoes became connected with planetary volcanism (Sigurdsson 228). Volcanoes did not stop erupting in the twentieth century: Santa Maria (1902) in Guatemala, Novarupta (1912) in Alaska, and Pinatubo (1991) in the Philippines were all roughly the same size as Krakatoa, VEI six. Eruptions were still deadly in the twentieth century. Mont Pelée on Martinique killed 29,000 people in 1902 (Oppenheimer 50). Santa Maria's 1902 eruption and the 1985 eruption of Nevado del Ruíz in Columbia both killed thousands of people (Oppenheimer 50). Geology at the beginning of the twentieth century was on the edge of articulating a grand unifying theory: continental drift. The idea of moving continents had started to exit the fringe of geological studies, culture was primed to consider geological discoveries after the science's popularity in the nineteenth century, and evidence was mounting in favor of drifting landmasses. All of these facets coalesced in Alfred Wegener's treatise *The Origin of the Continents and Oceans* (1915) which shows the ways that geology was beginning to be systematically connected with other features of the environment, like life and climate.

Alfred Wegener (1880-1930), like others, first considered continental drift thanks to the symmetry between Africa and South America. Wegener's name might also be read alongside Jean-Bapiste Lamarck's as scientists who *almost* discovered important features of the natural world, which is unfair to both. Wegener's work attempts to unify evidence from a wide range of earth sciences and life sciences to articulate a definitive history of

the earth. Wegener's initial paper titled "Die Herausbildung der Grossformen der Erdrinde *(*Kontinente und Ozeane), auf geophysikalischer Grundlage" ["The geophysical basis of the evolution of the large-scale features of the earth's crust (continents and oceans)"] was read to the Geologische Vereinigung [Geological Association] in 1912. He expanded on his theory in *Die Entstehung der Kontinente und Ozeane* [*The Origin of the Continents and Oceans*] originally published in 1915, with the second edition in 1920, the third 1922, and the fourth and final in 1929. The editions were thoroughly updated by Wegener; the introduction to the fourth edition notes "Each edition was a complete revision" to refute strident criticism (Wegener iv). The scope of data that Wegener used for his arguments makes those revisions all the more impressive.

Wegener's work draws on many different sources of information to argue for continental drift. As Naomi Oreskes notes, "Wegener's goal was nothing less than a grand unifying theory" (Oreskes 56) which he achieved by using geography, zoology, botany, biology, geology, geophysics, oceanography, paleoclimatology, and a variety of other sciences. Wegener is aware of the scope of his work. He argues that scope is one of the most important features of the earth sciences, stating in his forward, "Scientists still do not appear to understand sufficiently that all earth sciences must contribute evidence towards unveiling the state of our planet in earlier times, and that the truth of the matter can only be reached by combining all this evidence" (Wegener vi). The main problem, according to Wegener, is that other researchers are not working towards synthesis. His diagnosis is that "each scientist deeming his own field to be the one most competent, or indeed the only one competent, to judge the issue" (Wegener vi). Geophysicists believe

only geophysical data will bring them to the truth, whereas paleontologists believe only their data will, etc. Synthesis was more valuable, especially to Wegener, as he seemed to think that the ability for synthesis was waning. The fourth edition even notes that such research is moving beyond the ability of any single individual to grasp: at the end of the introduction, Kurt Wegener says that his brother "had already decided by 1928 that a new revision of his book would be beyond him because the literature relevant to the problem had become too extensive and specialized for a single worker to survey" (Wegener v). Wegener's death in Greenland halted any further revisions. The quotation suggests though that had Wegener survived he might not have been able to defend his theory by revising *The Origin of the Continents and Oceans* further. The breadth of data required would have been beyond his ability. As it is, the amount of evidence in *The Origin of the Continents and Oceans* is quite expansive, especially as it connects with geology and volcanology.

In the fourth edition, Wegener cites a whole range of fields and their data: geology, biology, physics, chemistry, geography, climatology. As with Adam Jefferson, Wegener says an epiphany was his first consideration of continental drift "the first concept of continental drift came to me as far back as 1910, when considering the map of the world, under the direct impression produced by congruence of the coastlines on either side of the Atlantic" (Wegener 1). To support his realization Wegener gathers data from many different fields. One of the first pieces of evidence that Wegener uses in his text on geology is from the fields of paleontology, zoogeography, and phytogeography. He notes that scholars in those fields have established that an "undisturbed interchange of

terrestrial fauna and flora took place" between various continents (Wegener 5). Rather than leaning on some feature of the earth itself, Wegener uses the inhabitants of earth and evolutionary theory to attempt to make his case before starting with geology or a related field. Wegener's usage of knowledge from the life sciences towards the beginning of the treatise is not off-hand either: he devotes entire chapters of his work to other fields of study so that he can conclusively demonstrate the veracity of his theory.

Wegener makes links between geology and biology in chapter 6, where he discusses the paleontological and biological arguments for continental drift. To start the chapter, Wegener notes that geophysicists and biologists are on "the wrong track" if they do not keep each other's discoveries in mind (Wegener 97). Wegener is referencing the two dominant landmass theories in each field: permanence theory in geophysics and land-bridge theory in biology. Permanence theory (which contrary to the name did not believe that the earth was unchanging) argued that the oceans and continents could not change position (Oreskes 17). The theory explained some of the observations geologists had made in regards to the makeup of oceanic rock versus continental. Biologists though needed to explain how the same plant and animal life managed to end up both in North America and Europe, or Africa and South America. They developed land-bridge theory, which stated that in the past massive continental blocks existed between the modern continents. Land-bridges would allow plants and animals to move between continents. These two theories contradict, which is why Wegener argued that the two disciplines needed to be considering each other's data.

Continental drift solves both the needs "of land-bridge theory and of permanence theory" (Wegener 21). To show how his theory resolves the problem, Wegener refers to the distribution of both pearl mussels and perch (Wegener 101) which can be found in both Europe and North America. Given that both perch and pearl mussels require a very specific environment, freshwater, the hypothetical land bridge would have to have enough streams to allow these animals to leapfrog across the Atlantic Ocean. If that were the case, as Wegener argues, then the animals would be confined to the margins of the continents, rather than distributed in disconnected places as they are (Wegener 102). Or another example, among the many that Wegener presents, is the flora and fauna of Australia, which more closely resemble South American flora and fauna rather than the much closer East Indian flora and fauna (Wegener 110). Wegener refers to a large number of other scholars and quotes many of them at length to demonstrate his point. Without the cross pollination between biology and geology, new understandings of the world would be stunted and less dynamic.

Part of Wegener's fame is his climatological work, so it is not surprising that paleoclimatology plays a large roll in his argument. In 1924, Wegener together with Wladimir Köppen published *Die Klimate der Geologischen Vorzeit* [*The Climates of the Geological Past*] which he uses as the basis for chapter 7 of *The Origin of the Continents and Oceans*. Wegener starts off by noting that paleoclimatology is a necessarily interdisciplinary science: "palæoclimatology can thrive only as a unification" (Wegener 121) of geology and paleontology. Data from those fields allows Wegener to reconstruct the past environment. Wegener uses the distribution of coal as an example because it

"indicates a wet climate, which may be an equatorial rain belt, one in the temperate latitudes or a subtropical wet climate in the monsoon areas on the eastern margins of continents" (Wegner 124). Coal is the remainder of wetland forests which were compressed under other soil and rock for thousands of years. As Wegener points out, those conditions only occur in certain climatic zones. One would expect to find coal only in those areas if continents were static. But coal can be found "traversing North America, Europe, Asia Minor and China" suggesting those regions were "*in the equatorial rain belt*" (Wegener 138). Wegener uses drift theory to imagine a historical environment where regions far removed from the equator were instead in a line, soaked with rain and covered in tropical flora. Wegener uses limestone as a similar example. Limestone is largely made up of the remains of marine organisms. The remains are compressed over time and eventually transformed into the rock. Wegener says that deposition of lime beds can only occur "in the warm waters of the tropics and subtropics" (Wegener 125) and thus limestone can only form in regions that were warm enough *and* were covered by an ocean. As with the coal example, Wegener is reconstructing the past using two different sets of knowledge, both geological and climatological to prove his point. In the process he helps create a better understanding of the world environment as land masses grow and shrink. The interdisciplinary nature of Wegener's work helped him craft a world where moving continents affected the trajectories of life.

Other scholars noticed the wide disciplinary reach of Wegener's work. The geologist Émile Argand claims that "Drift theory is firmly based on the areas where geophysics, geology, biogeography and paleoclimatology overlap, and it has not been

refuted" (Wegener 96). Unsurprisingly, Wegener in the last chapter agrees claiming that "The determination and proof of relative continental displacements, as shown by the previous chapters, have proceeded purely empirically, that is, by means of the totality of geodetic, geophysical, geological, biological and paleoclimatic data, but without making any assumption about the origin of these processes" (Wegener 167). Before Wegener attempts to explain the mechanism, he notes that he collected a wide range of data that supports the idea of drift even if the mechanism is not well understood. At the end of the text, Wegener is convinced that with enough data the causal mechanism for drift will be completely understood and continental drift will unite most features of the earth sciences: "Continental drift, faults and compressions, earthquakes, volcanicity, transgression cycles and polar wandering are undoubtedly connected causally on a grand scale. Their common intensification in certain periods of the earth's history shows this to be true. However, what is cause and what effect, only the future will unveil" (Wegener 179). Plate tectonics would unify all of the phenomena that Wegener lists, but that is cold comfort for Wegener who worked so hard to get his grand unified theory accepted fifty years earlier. Nevertheless, Wegener's theory does unify diverse fields to create a causal environment, where plants and animals connect with rock and soil.

Despite mustering such a wide range of data, Wegener's theory was rejected. The rationale for the rejection of continental drift often centers on the lack of mechanism (Oreskes 62). Oreskes, though, has shown that the rejection of Wegener's theory was largely due to differences in the German and American methods of science, which caused American scientists to try the hardest to refute Wegener's claim (Oreskes 155). The lack

of a persuasive mechanism did hamper Wegner. But evolution was not accepted blindly after Darwin; there was debate about evolution both before and after 1859. What might make the difference between the two grand unifying theories is the nature of the knowledge that was used to construct them. Although Darwin utilized a wide range of scholarship, his theory required only one disciplinary field and few specialists. Wegener realized he was less and less able to individually construct a theory; more and more specialists were required develop a theory but they were not collaborating. Frankel has argued that Wegener's broad synthesis was the reason that he was not well received (Frankel). Le Grand adds onto this by noting that "geological 'localism' and the fractionation of geology into a plethora of specialties could create obstacles for any overarching, synthetic theory including Drift" (Le Grand 80). Thus unlike Wegener, most of his opponents "rather than taking the global view advocated by Wegener, […] were quite parochial" (Le Grand 93). Stewart concurs, saying that research in the earth sciences was narrowly focused until plate tectonics: "Following World War II geoscience researchers continued their emphasis on specialized research without much concern with the development and testing of global theories" (Stewart 45). Over-specialization and a lack of global interest were a contributing factors in the rejection of continental drift.

Perhaps because of the rejection of continental drift in the twentieth century, geology seemingly declined in the public sphere despite being so popular in the nineteenth century. One way to track the decline of geology is through Google's Ngram viewer which displays the frequency of words in a few different languages. In the case of geology and continental drift, the ngram viewer is particularly enlightening, as the viewer

shows the downward trend for geology and little usage of continental drift. The ngram viewer is a very broad spectrum tool, which means there are flaws in trying to extrapolate from the data. The data set is limited by whatever Google included. They describe the collection as "a corpus of books" which means that other published materials, material that is difficult to scan, digitize, and read with optical character recognition software is left out. Further, merely writing a word does not necessarily mean that it is being used in the way that one might assume. As with any data a degree of interpretation and critical distance is required. The usage of the word geology does show a downward trend between the middle of the nineteenth century and the end of the twentieth century.

All of the searches on the ngram viewer were done with a smoothing of zero, to prevent the program from averaging the data. This way each year displays the exact the frequency of a given word. Also, the searches were run as case-insensitive, so that both Geology and geology would turn up together. The searches were run in these ways to reduce any obfuscation in the data. The data points are listed as percentages, which indicates the frequency of the word in the data set that Google is sampling from. For example "the" in 1901 is used about 6% of the time in English, "to" is about 2%, and "I" is used about .5%. Most of the rest of the percentages will be far smaller though, due discipline specific nature of the words. Being discipline specific is a strength of a search for words like geology, as they are rarely used outside of their own context.

In 1860, geology was well used at .0011%. By 1900 this had changed though, with geology down to .00089%. In 1920, seven years after Wegener's first paper on continental drift, and five after his first book, geology is used .00079% of the time, and

continental drift was not used at all. Only in 1925, a year after the English translation of Wegener's work by J. G. A. Skerl (Wegener iv), does continental drift register at .0000028% while geology had returned to .0010%. By 1960, geology had maintained its .0010%, although fluctuating frequently in the thirty-five year gap. And continental drift had increased, but only a sliver to .000018%. And even in 2000, in contrast to the growth of the life science terms, geology is at .00062%, continental drift at .000027%, and plate tectonics at .000050%. All decreases from former positions, even plate tectonics whose apex was .000089% in 1990. Even in German, a search for "Kontinentalverschiebung" and "Kontinentaldrift" both ways of saying continental drift shows that initially the word was not met with much enthusiasm, no usage appears until 1917, five years after Wegener's initial talk. The words reached an early maximum in 1930 with .0000098% for Kontinentalverschiebung and .0000052% for Kontinentaldrift. Kontinentalverschiebung reached its apex in 1980 at .000015% of the time, and Kontinentaldrift reached its in 1985 at .000015% of the time also. The word Geologie arcs between 1860 and 2000, starting off at .00042% in 1860, reaching the arc's apex in 1920 at .00092%, and settling down again in 2000 at .00025%. The trends in geology, which are more complicated than this report can easily show, are typically down in both of these searches.

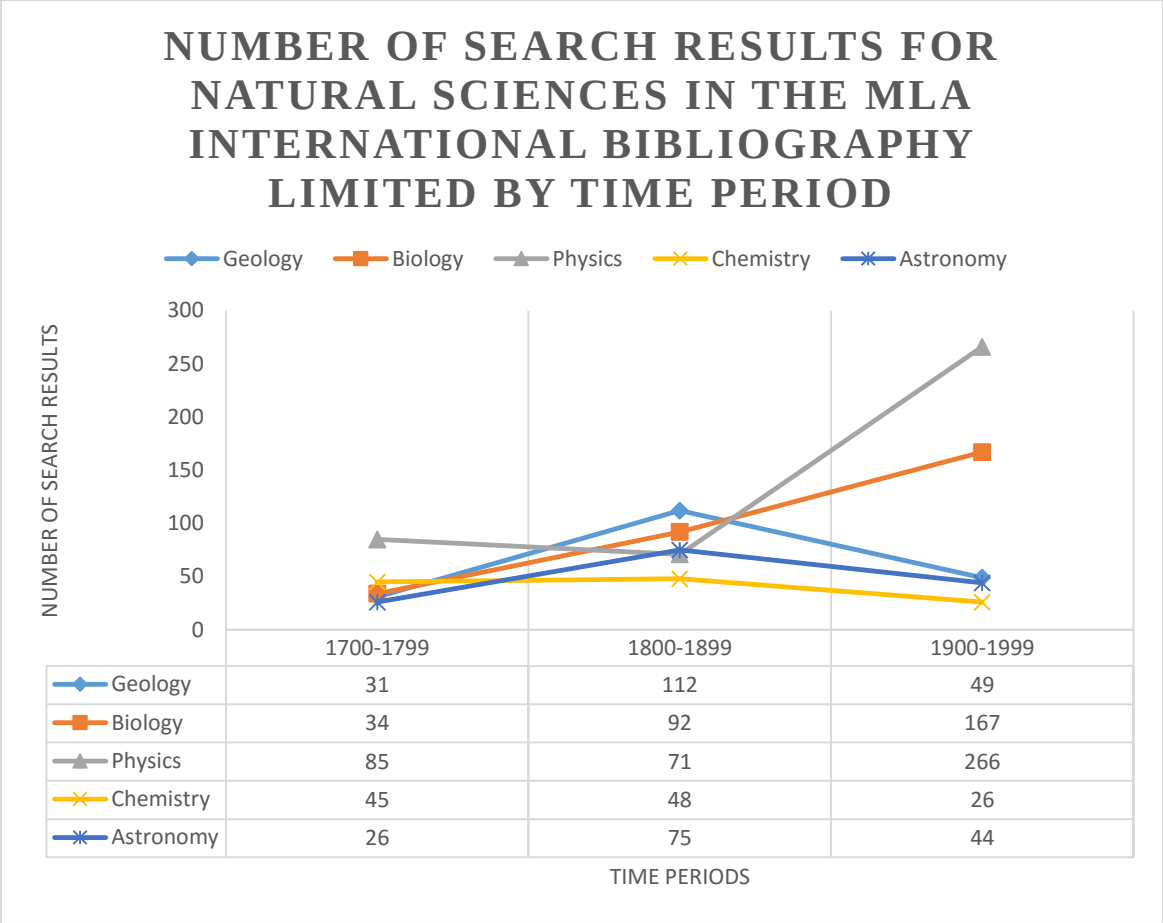
The strident rejection of continental drift by American geologists certainly did not help. The increasingly disciplinary and professionalized nature of geological research, identified by Wegener as an impediment to further individual work, would have also kept out lay readers. Continental drift faces a question of applicability: evolution as a

mechanism influences living creatures and seems to have a direct impact on human life. The movement of the continents over millions of years seems quite removed from anyone's life. Of course, natural selection also takes place over time, and plate tectonics influences daily lives through earthquakes and volcanoes, among other features. Conceptually, evolution and continental drift seem far apart. Additionally, the increasing importance of other sciences, like physics, also diminished of geology in the popular sphere "geologists in the twentieth century did not live in a vacuum; they lived in a scientific world increasingly inhabited by physicists" (Oreskes 311). In 1860 physics is used .00041%, less than geology's .0011%. By 1900, physics has caught up with .00096%. By 2000 physics is used .0024%, almost four times more than geology at the same time. The failure of continental drift led to the weakening of geology within culture. Perhaps due to the increasingly complex nature of geological research, culture too was less attuned to geological discussions.

Tracking such a broad cultural trend, like a weakening of geological interest in culture in the twentieth century, is quite difficult. Only the edges of such a trend might ever be illuminated. The argument here will attempt to do just that using the *MLA International Bibliography* as a source of information. The *MLA International Bibliography* is the database for the Modern Language Association, a professional association for scholars working in language and literature. The bibliography "provides a subject index for books and articles published on modern languages, literatures, folklore, and linguistics" ("MLA International Bibliography"). The database indexes a wide range of scholarly work on culture. The scholars' whose works are in the bibliography represent

a diversity of professionals whose work focuses on culture. They are well-trained to recognize important or dominant trends in culture, like the relative valences of a given science within society. Of course, scholarly work will also follow dominant trends within the academy, but the search here will only make comparisons between items tagged as part of the natural sciences to keep consistency and provide a static baseline.

The searches were conducted looking for the names of the natural sciences: geology, biology, chemistry, astronomy, and physics anywhere in the materials, so it could be in the title, subject, abstract, body, etc. Then time period was used to limit the searches between 1700-1799, 1800-1899, and 1900-1999. The rationale for the periods is that the twentieth and the nineteenth centuries are the area of interest. The eighteenth century is included to help give a bit more context to the changes. By searching through constrained time periods, some results that would have otherwise occurred are left out. If a scholarly work were not connected to a time period, then it would be left out of the search. As the nature of the search is temporal though with the goal of comparing periods, the exclusion of a few texts was acceptable. The searches were not limited in anyway, so they turned up journal articles, books, book chapters, and dissertations. The results of these searches are displayed below.



The trajectories for geology, astronomy, and chemistry are all down in the twentieth century, although geology decreases the most, from 112 results to 49 results. Physics and biology though show upward trajectories, with physics gaining substantially between the studies of the nineteenth century and the twentieth century. Interestingly, this graph is similar to a Google ngram search for the five sciences between 1800-2000, using the same constraints established earlier: Physics and biology increase in frequency from the beginning of the nineteenth century until the end of the twentieth century, where geology and astronomy increase in the nineteenth but decrease in the twentieth. Only chemistry runs counter to the trend in the *MLA International Bibliography*, increasing from the

nineteenth century and into the end of the twentieth. This trend might have to do with the migration of the term chemistry to refer to more than just the science, such as attraction. Of course, just because a period does not return appropriate numbers does not mean necessarily that geology was less important in culture. The search relies on the professional skill and eye of scholars of culture, who are as fallible as anyone else. Nevertheless, even if there are some errors in the search, the overall trend is illuminated by the trajectories in research: geology was just not as important in the twentieth century as it was in the nineteenth.

Volcanoes and a variety of other terrestrial phenomena would eventually become wrapped into the theory of plate tectonics. Stewart claims that it was in the 1960s and 1970s that earth scientists finally experienced a paradigm shift even though "most thought the earlier ideas about continental drift were ridiculous and had been given a proper burial before World War II" (Stewart 1). Sigurdsson notes that it was interest in volcanic rift zones, like the one dividing Iceland, home to both Laki and Eyjafjallajökull, which completed the igneous system (Sigurdsson 228). Now plate tectonics is the dominant paradigm, and volcanoes are seen as an important feature of that system, as they largely occur along plate boundaries, excepting hotspots like Hawai‘i. Getting volcanoes to that point though required a substantial collection of data and flexibility of thought.

Sir William Hamilton's observations of Vesuvius helped begin modern volcanology, especially as he saw and articulated the scope of time that the volcano occupied. Writers like Hester Piozzi and Priscilla Wakefield contributed to growing ideas

of volcanoes by showing just how small human societies were in comparison to volcanoes and how human systems were impacted by volcanic ones. Charles Lyell and Sir Edward Bulwer-Lytton further increased the distance between human beings and volcanoes by removing symbolic meaning from volcanoes in their scientific and literary texts. Constance Gordon-Cumming, along with other Victorian travelers to Hawai‘i helped reshape conceptions of what a volcano was and in the process further developed a new sense of the many ways that volcanoes occupy geologic time. M. P. Shiel, building on a variety of scientific theories including the forerunners of continental drift, created a world were volcanoes are a feature of the environment, one that actually impacts the evolution of the human race, finally making all the connections between the ways that volcanoes operate throughout the world. But Wegener's failure is an important moment in the development of systematic igneous thinking: even though there was substantial evidence, from a variety of fields, and a few people were able to successfully imagine a dynamic planet like Wegener described, his ideas were tossed into the same bin as phlogiston and spontaneous generation. Eventually the persistence of Arthur Holmes and new magnetic data provided by Fred Vine and Drummond Matthews meant that plate tectonics became widely accepted (Sigurdsson 228). New data ultimately incorporated volcanoes into a planetary system finally linking the hyperobject to the environment. Grasping the environment around human societies will always require more data, but imagination, thinking about the world outside the human frame, is a valuable tool for reaching new conclusions.

Today, a variety of citizens, policy-makers, and scholars are attempting to understand and grasp the features of global climate change. A Pew Research Center poll noted that in 2014 fifty percent of U.S. adults agreed that "the Earth is getting warmer because of human activity," twenty-three percent thought the warming was due to "natural patterns," twenty-five percent believed that "there is no solid evidence," and the remaining percentages "don't know," despite overwhelming consensus within the scientific community (Pew Research Center 37). Many social scientists are hard at work attempting to understand the why the American public is so intransient about acknowledging climate change and its effects. While the argument here provides no answers to that question, it shows the how development in thinking about hyperobjects changes over the course of a century.

Ian Bogost notes that one of the difficulties with much modern environmental or ecological philosophy is that it focuses on typical features of nature, like forests, and only does so for the ultimate benefit of human beings (Bogost 7-8). In his most recent work, *An Inquiry into Modes of Existence* (2013), Bruno Latour frames his argument through ecology, looking at how science studies and its methods might be a positive (not negative or deconstructive) force for understanding a variety of modern concepts. As he is setting up his argument he says, "If geologists themselves, rather stolid and serious types, see humanity as a force of the same amplitude as volcanoes or even of plate tectonics, one thing is now certain: we have no hope whatsoever – no more hope in the future than we had in the past – of seeing a definitive distinction between Science and Politics" (Latour 9). Importantly, Latour is noting the collision of objectivity and rhetoric; that one of the

key ways to understanding society and the environment going forward will require an understanding their connections. One way forward, as Latour suggests, is by understanding multiple modes of existence of "ontological pluralism" (Latour 21). Ontological pluralism is important to better understand the various features of the world, the most pressing being climate change. As Markley notes, climate change presents a challenge for human understanding because

> The expanses of pre-human history that extend into the deep backward and abysm of time underscore the fact that climatological time, measured in millennia, exists beyond daily experiences of the weather, beyond the duration of individual lifetimes, beyond the accumulated memories of generations, and beyond the technologies of observation. (Markley 56).

Climate change, like volcanoes, extends beyond human perceptions. To grasp these objects, people need to reconsider the ways that both objects and the environment are defined. Morton argues that hyperobjects provide an antidote to the modern mode of thinking, "hyperobjects spell the end of environmentalisms that employ Nature (a tool of modernity) against modernity, fighting fire with fire, matter with matter, the present with the present" (Morton 199). What Morton suggests is that hyperobjects help define the environment as unconcerned with questions of aesthetics or value, typically the domain of Nature.

Thus, looking at volcanoes, hyperobjects that are rarely thought of as valuable or aesthetic, in the nineteenth century offers a potential map for developments in thinking about climate change now. Understanding the ontology of hyperobjects requires thinking outside of the human frame and attempting to understand the existence of our environment. Thinking like a volcano though is challenging, as one needs to push away

from human conceptions of time, space, meaning, connectivity, and causality. And even despite that effort, the human imagination might not always be up to the task, so the event needs even to be altered to match human perspectives better, like Gordon-Cumming's experience of Kīlauea. Most importantly, these objects have not reason or need to incline themselves to the human mind's perception of the world. Volcanoes do not rely on human beings for existence nor are they sentient. They merely are. But if humanity does not attempt to understand a volcano, then people will both suffer and die. The same is true of climate change, and the onus is on human societies to work towards mitigating it because, like volcanoes, only people will suffer if climate change goes on ignored. The planet will be fine, life may or may not continue, but the human race's survival will be perilous.

Humanities research is not often thought of as practical, and a dissertation on nineteenth-century volcanoes might seem to confirm that negative stereotype. I reject that assessment as narrowly parochial. History and culture are one of the few sets of data that we have to understand how human cultures organize and act; the nineteenth century is the only set of extant data for an industrialized, globalized culture that had similar conceptions of both science and the environment that we have in the present. Certainly, the comparison is not perfect, but few comparative studies are. The value derived from looking at historical conceptions of volcanoes, especially the changes that occurred over more than a century of observation and speculation, is the ability to see which modes of thinking were the most beneficial to reaching the current understanding of volcanoes. In blunt terms, those are:

- Ontological thinking, i.e. thinking about how other objects and phenomena exist, is important to any environmental question because the objects of an environment and their existence do not conform to human experiences of existence.
- Ontological thinking requires an openness to different conceptions of time, space, meaning, connectivity, and causality.
- Interdisciplinarity is one way towards promoting ontological thinking.
- Interdisciplinarity is further valuable in its ability to bring a diversity of knowledge to any given problem, even if that knowledge might not seem applicable at the moment.
- Understanding hyperobjects, and thus the survival of the human species, requires both ontological thinking and interdisciplinarity.

Eighteenth century and nineteenth century thinkers and writers succeeded at implementing those ideas. Hester Piozzi at Mount Amiata thought about the volcano's being, how it existed through time and expressed that expanse through time aesthetically. She thought about the volcano's ontology and then attempted to express that mode of being in human terms. Charles Lyell used geology, archaeology, and aesthetics to come to his conclusions about Vesuvius. He deployed interdisciplinary thinking to grasp a complex ontologically problem. M. P. Shiel crafted a fictional world where the human species is affected by a volcanic eruption. Shiel's novel shows an understanding of the hyperobject and how it affects human survival. Thanks to the work of a number of people in the nineteenth century, understanding volcanoes and their risks today is better than ever. Pinatubo's 1991 eruption was roughly the same size as Krakatoa's 1883 eruption,

and “Although the eruption caused hundreds of fatalities and major damage with severe social and economic impact, successful monitoring efforts greatly reduced the number of fatalities” (“Pinatubo”). Despite the similar size, the fatalities in the 1991 eruption of Pinatubo were only two percent of Krakatoa’s 36,000 (Rodolfo 987). While volcanic risks are still present, the work done to attempt to understand volcanic ontology in the eighteenth and nineteenth centuries has allowed for improved comprehension and risk mitigation in the twentieth and twenty-first centuries.

Volcanoes seem narrow: only a few people need consider or worry about them. According to Small and Naumann only nine percent of the world’s population in 1990 lived within one hundred kilometers of a historically active volcano (Small and Naumann). Any volcanologist or environmental historian, though, would note that proximity does not correlate with security; merely living one hundred and one kilometers or thousands of kilometers away from a volcano does not ensure safety. The entire planet is volcanic, constantly in motion, shifting and rupturing. Dismissing the threat of volcanoes again misses their non-locality and viscosity. Environmental dangers, whether anthropogenic or not, have and will continue to define human societies. The eighteenth and nineteenth centuries provide a rough template, through the work of travel writers, educators, novelist, and scientists, of how to come to grasp an environmental hyperobject, which still can be utilized today. Deploying this template will be a product of our ability to think outside our own perspectives, use diverse arrays of knowledge, and cooperate so that neither climate change nor volcanic mass extinction become the end of humanity.

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