Languages of Volcanic Landscapes

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As a young geologist in 1980, I felt a powerful attraction to volcanoes, and I thought I knew volcanoes rather well. I had studied volcanology. I had climbed volcanic peaks in the Cascades. And I had tried to be an attentive citizen of my volcanic region, the Pacific Northwest. But when I had a chance to go with other scientists to Mount St. Helens within days of its May 18th, 1980, eruption, that all changed. I stepped out of a helicopter into the dust and mist of the blasted landscape, and I could barely comprehend where I was. Everything was gray in the normally green Pacific Northwest landscape. Muddy geysers erupted on the newly formed Pumice Plain below, and the volcano responsible for this chaos was hidden in clouds. The helicopter radio passed on messages of continuing harmonic tremor, signaling possible further eruptive activity. My preconceptions of how volcanic landscapes behave in the aftermath of an eruption were blown away like the top of St. Helens, and I've been reconstructing my understanding ever since.

From that day forward my engagement with volcanoes has only intensified. I eagerly follow the latest developments in geology and ecology, but I've also become interested in cultural responses to eruptive landscapes, to the ways in which societies and their languages adapt to living with volcanoes. It has been fascinating to think about the many ways we speak about volcanoes: we use the scientific language of volcanology, of course, but also a language of ecological responses to volcanism, and a language of human engagement with volcanic landscapes. Culture permeates each of these languages.

Cataclysmic volcanic events profoundly change cultures and ecosystems, testing our emotional reactions and our language.

Where volcanic events have become familiar, they have spawned technical terms of cultural origin. This geological language of volcanoes has become part of our general vocabulary, and finds a place in the language of poets as well as scientists. The language of human and ecological responses to change commonly carries a sense of personal, corporate, and public values—intended or unintended. Mount St. Helens is a great place to reflect on these intersections of volcanoes, culture, and language.

Some Volcano Vocabulary

Volcanoes ring the globe and erupt in many ways and in many cultures. This cosmopolitan setting of volcanism produces a global etymology for the vocabulary of volcanic landforms, materials, and processes. Much of the technical language of volcanology was born in culture, not science. Some terms are obscure and opaque; others evocative. A few examples reveal the richness of this language and its cultural roots.

"Mudflow" is a common descriptive term for the rapidly moving slurries of water, sediment, boulders, and trees that flow from the flanks of volcanoes and down river channels. But volcanologists are more likely to use the Indonesian (Javanese) term "lahar" for volcanic mudflows. A colloquial Chinese term for mudflow translates as "sludge dragon"—a roiling, coiling, and dangerous beast, an appropriate image, since lahars kill more people than other volcanic processes.

A "pyroclastic flow" is a rapid, turbulent flow of exceedingly hot gasses, ash, and rock fragments. The French, who have studied such processes at volcanoes in French colonies, such as Soufriere Hills on Montserrat, call them "nuée ardentes" or "glowing avalanches." Pyroclastic flows occurred repeatedly at Mount St. Helens in 1980, and piled up at the foot of the north flank, forming the Pumice Plain. Like lahars, pyroclastic flows are fast and very dangerous volcanic processes.

Any fine-grained volcanic material that falls from the sky is commonly and casually called "ash," but to a volcanologist this

term is restricted to particles less than 0.08 inches (2 mm) in diameter. The Greek word "tephra" is the more general term for any volcanic debris—particles big or small—fallen from the sky. A common style of eruption producing tephra of widely ranging particle size is the violent "Plinian" type, named for the Roman Pliny the Younger on the basis of his deliberate description of the explosive eruption of Mt. Vesuvius that inundated Pompeii in AD 79. The Italian term "lapilli" refers to tephra ranging in diameter from 0.04 to 2.52 inches. My favorite tephra term is "accretionary lapilli," which are little spheres of very fine ash stuck to water droplets, forming mudballs of the lapilli size class. Accretionary lapilli formed in the climactic Mount St. Helens eruption when the finest ash in the dust cloud produced by the blast collected on water droplets condensed from the steam that drove the blast. I got an up-close and a bit too personal view of these mudballs as they splattered on the windscreen of our helicopter during that May 28, 1980, foray to Mount St. Helens. As the ash drifted northeastward with the wind, accretionary lapilli formed and fell to the earth, blanketing the landscape with a layer up to nearly an inch thick. This distinctive deposit impeded the flow of water into the soil and the exchange of gases between soil and atmosphere, contributing to the death of many old-growth fir trees in areas northeast of the volcano.

Lava flows are perhaps the most common image of a volcanic process, but none occurred in the 1980 eruption of Mount St. Helens. The black, fluid lava of Hawaiian volcanoes sculpts fascinating forms in rock and glass. The sharp, clinkery rubble surface of an "a'a" lava flow or the smooth, ropy-textured surface of a "pahoehoe" flow invoke a sense of the exclamations barefoot Hawaiians might have uttered walking across them, perhaps giving the different surfaces their names. One is treacherous, the other provides easy traveling.

Hawaii is also the source of the term "Pele's hair," the fine, golden glass threads of cooled lava spun from blobs of lava thrown into the air during a fountaining eruption of very fluid,

incandescent magma. The small blobs themselves may take the form of teardrops termed "Pele's tears." Pele is the Hawaiian goddess of fire, lightning, and volcanoes.

The language born in these various cultures is widely used because mudflows, eruptions of tephra, and lava flows are common globally where volcanic events occur. Our language for very infrequent volcanic events is more clinical, less settled, and perhaps less interesting. Giant landslides occur in the lifetime of many high, steep-sided stratovolcanoes characteristic of some volcanic chains such as the Cascade Range, but are rare in recorded history. Massive volcanic landslides take on many names, such as "debris avalanche," "rock avalanche," and "sector collapse," indicating that a major chunk of a volcano, including the summit, breaks loose and flows out onto the surrounding terrain. The landslide instrumental in triggering the 1980 eruption of Mount St. Helens—two-thirds of a cubic mile of mountain top—was the largest landslide ever observed on earth. But it was only a tenth the size of one that eviscerated Mount Shasta three hundred thousand years ago.

Huge volcanic blasts, such as the one heralding the eruption of Mount St. Helens, are also rare in human history and probably in geological history as well. Consequently, the terminology is unsettled, even disputed, among specialists who each have their own ways of interpreting the process and, hence, the appropriate, literal terminology. Even within a single geological report documenting the 1980 activity of Mount St. Helens, this single event was referred to as the "directed blast," "pyroclastic density flow," "pyroclastic surge," and simply "blast."

These examples suggest that the language for volcanoes and their self-constructive and self-destructive processes may have strongest cultural undertones where a culture has experienced numerous volcanic events or where chronicles of volcanic eruptions have had lasting impact. The language for volcanic processes that are rare, especially in parts of the globe without deep written histories, may be sparse. For these, it may fall to the

science community to settle on a vocabulary, and the wrangling over terminology may go on for decades.

Language of Ecological Responses to Eruptions

How do we react to, think about, and discuss a landscape transformed by violent volcanic eruption? The scientific language of volcanology attempts to be descriptive, avoiding, as much as possible, references to human values, and in this it has some parallels with language used to describe ecological responses to big disturbances, such as volcanic eruptions; but there are also some important differences between geological and ecological vocabularies. Our language for processes of ecological change, employing terms such as *succession*, *immigration*, *survival*, and *competitive interactions*, is intended to be descriptive, though we can sense strong anthropomorphic hints in these terms. Human values appear clearly in descriptions of initial effects of the disturbances and prescriptions for management of ecological change thereafter.

Right after the 1980 eruption of Mount St. Helens ecologists and the news media spoke of "the devastated area," "the zone of devastation," "a moonscape." But, soon, surviving organisms and surprising pioneers appeared. It became clear that there were both winners and losers, ecologically speaking—some species had their numbers eliminated or greatly reduced while others found new opportunities to flourish. Ecologists developed a more nuanced understanding of the volcanic impacts, and their language followed. The single devastation zone came to be seen as separate disturbance zones with distinctive properties—the down-tree part of the blast zone, the standing-dead or scorch zone, and the pumice plain of pyroclastic flow deposits where ecological development had to begin essentially from scratch. Ecologists began to avoid the hot language of "devastation" for the greening landscape, and to focus more on the nuanced "responses" of ecosystems to the disturbance.

More *pre*scriptive terms concern notions of where ecosystems had been in the past and where they may be headed. What are the relevance and meanings of the terms "recovery," "reestablishment," and "restoration" in a place of such profound change? What can we hope to restore, what should we not, what can we not? Responses to these questions depend on our attitudes about nature and our place in the world. Initial expectations that we would observe ecological "recovery" and could direct "restoration" to pre-disturbance conditions gave way to the realization that the path of ecological change in natural systems was quite different from human efforts to restore forests, lakes, and streams. For systems permitted to develop without human intervention, each spot on the landscape was on its own path, and pre-1980 conditions were probably not their destination. The notion of "recovery" may be relevant to specific components of an ecosystem in specific parts of the Mount St. Helens landscape, such as certain fish species in lakes where both the lake and the fish existed before the 1980 eruption. But some parts of the landscape are new places on the face of the Earth—the crater, new lakes, and the debris avalanche deposit, which raised the land surface up to six hundred feet in places. "Restoration" and "recovery" are not taking place there—these are wholly new ecological systems.

Concepts of recovery and restoration in greatly altered landscapes raise very challenging questions. Where should we plant trees, put fish in lakes, or alter stream channels in the name of ecological recovery, commodity production, or our perception of doing good deeds? This comes down to a matter of personal values, which may be expressed through corporate and government actions. In the blast zone of Mount St. Helens the timber industry quickly "salvaged" dead trees and planted a new forest, and the U.S. Forest Service did likewise on some federal lands. But Congress established the first-ever National Volcanic Monument, directing that natural processes should "proceed substantially unimpeded." So now vigorous, young tree

plantations grow on one side of the boundary of the Monument, and on the other side stands a complex ecosystem with shrubs, herbs, scattered trees, and diverse assemblages of animals. Which is right, which is wrong? Which good, which bad? In America we possess a wealth of space, so we can often have it both ways and learn from the differences.

Personal Language of Volcanic Landscapes

Thus, we reside in several layers of volcanic culture—the global scientific knowledge and language of volcanoes, the experience of the 1980 eruption of Mount St. Helens shared across today's cultures, and the cultural conflicts over responses to eruptions. In the Mount St. Helens volcanic landscape we can sense the presence of volcanoes in broad cultural terms, and also in strictly personal terms. We have engagements of fear, curiosity, neighborliness, respect, awe. In the myths of Native people of this region, whose cultures have resided here for millennia—long enough to experience many eruptions—volcanoes are battling gods, or wooing lovers. In contemporary society, as Ursula LeGuin has observed, Portlanders ask, "Is the volcano out today?" in reference to viewing our neighbors Mount St. Helens and Mount Hood.

My strongest feelings for volcanoes have no vocabulary. Whether I'm teetering at the lip of a crater rim, so wild and unstable no person should be there, or standing on a huge boulder facing directly up into the crater, or caught up in a moment of silence viewing the snow peak from my home sixty miles away, I come to the edge of language. I look to see what the volcano has to say today—cloud cap or wisp of steam from the dome or trail of dust from rockfall on the crater wall, or silence. The power and the presence are beyond words.

In the Blast Zone

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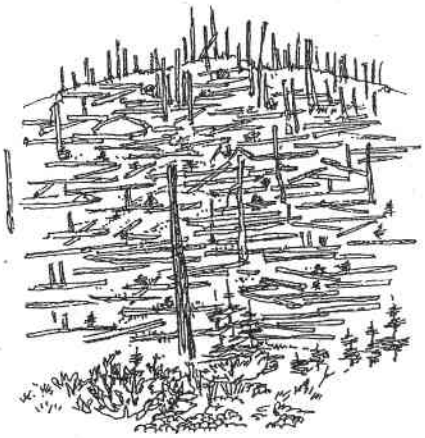

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