Notes about Managing Volcanic Risk and Hazards*

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When I left Colombia last year to pursue a degree in communication after practicing my professional career as a geologist, seismologist and administrator in two volcano observatories and the Colombian Geological Survey-INGEOMINAS, I thought I was going to become an expert in the management of volcanic risk and hazards. Almost a year has passed and during this time I have had the opportunity to learn new things that have caused me to re-think that idea. I will focus this discussion on some aspects of volcanic risk management, particularly, on noncrisis scenarios[1]. The use of the first person pronoun in my discussion is for two reasons: one to acknoledge that people have different opinions regarding this subject and the other is to emphasize that what is written here is the product of my own perspective, experience and background.

Certainly I have to accept that when I arrived to Arizona State University (ASU) I was thinking of communication only as a tool that could allow me to "fix" the communication between scientists and the community. From my very positivistic and quantitative perspective I thought I could "freeze" the communication process in order to manipulate its different components. As in seismic processing I thought I could "map" those areas where communication was not effective. I thought that I could "design" the best "path" for effective communication. However, through to the information received from the so-called "soft" disciplines of the social sciences I have understood that risk is a process the meaning of which is socially and individually constructed throughout the communication process. I learned that experts tend to focus fairly narrowly on what they are experts about and that organizational cultures and interests narrow the kinds of things considered legitimate to think about (Clarke & Freudenburg, 1993). I learned that the scientific aspects of risk "are embedded in a complex sociopolitical tapestry in which there are not only different voices but different perceptions of the problem" (Krimdky and Plough in Kasperson & Stallen, 1991, p. 5). I learned that risk "evolves" with the community and that in long-term situations in particular any manipulation or prediction could be a fallacy. I understood that particularly in non-crisis scenarios (prevention), instead of trying to represent a reality already lived more important is the awareness of living that reality, and that, therefore, instead of predicting and controlling the behavior and reactions of others, it could be more important to contribute positively with our knowledge and abilities to that collective construction.

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[1] I specify this because I believe that contrary to long term situations (prevention), in crisis situations (e. g., ongoing eruptions) where a quick reaction is needed and where people are often eager for information and prompt to receive guidance and instructions, manuals, handbooks, formulas, can be very useful.

During the last year, one of the most interesting things for me was the recognition of different paradigms on which the construction of knowledge can be developed. In particular, I learned that the understanding of risk reflects the characteristics of a dominant paradigm where the way the world is perceived has been heavily influenced by the anthropocentric belief that humans can perfect themselves through "rational" thought (Cooper & Burrell, 1988) --a paradigm where the positivist discourse characterized by its goals of "control" and "prediction" and belief in the scientific method are particularly overwhelming (Mumby, 1996; Pearce & Kang, 1988); a paradigm where reality is "frozen" or "discretized" in order to operationalize certain variables or parameters that allow the adjustment of "explanations" to the scientific method; a paradigm where nature is viewed as a "constellation of physical 'facts', unambiguously observable and unified through [the] positivist deductive method, [that has] welded together the entire body of social and natural sciences" (Watts, 1983, p. 233).

I wondered why this discourse was so dominant in both the social and natural sciences, especially in the study of the interaction between environment and human organizations. With its goals of control and prediction, this approach seemed very applicable, particularly in volcanic risk analysis where the population with its trust in science, expect at least warnings in advance of impending eruptions (e. g., many people think volcanologists are able to predict the time and dimensions of an eruption), if not control of the volcanic process (e. g. many people think that there are ways to stop an eruption). Certainly, as a consequence of the exercise of this form of inquiry, very important advances have been achieved. New techniques and methodologies for volcano monitoring have been developed. The level of detection for different indicators of activity inside the volcano has been dramatically increased. Today, it is possible not only to identify and locate with great accuracy seismic activity inside a volcano, but to associate it with other information such as deformation of the volcano. By the same token, social scientists following the scientific method have identified certain patterns of human behavior under circumstances of risk (e.g., as in earthquake risk) (see for example, Mileti & O'Brien, 1992).

However, from my viewpoint, it was also evident that these advances have not always been translated into a harmonious coexistence between volcanoes and human organizations (e. g., risk reduction). Struggles between communities, experts and decision-makers are common today. Early this year, the reaction to reports of seismic activity inside Mammoth volcano in California evidenced again the different and often opposite interests of different sectors of the community. Despite the important job of information dissemination done by the U. S. Geological Survey, the reaction of the actors or the "affected"[2] was just the same as the reaction one would have expected of people not very familiar with volcanic phenomenon (see enclosed photocopy). In contrast to researchers in technological risks where they can be at the same time evaluators and designers, in volcanic risk analysis researchers are not in a position of control, or design

[2] The affected are those who have experienced directly or indirectly the consequences of volcanic process (e. g. destruction of property). Luhmann (1993), refers to three categories of actors in risky situations: decision-makers, beneficiaries, and affected parties. For this author, the affected parties are not normally counted among the decision-makers.

and therefore, cannot predict, say for example, the next eruptive episode. The number of factors to consider in both volcanic and social structures is so large and often unknown, that it is not possible to predict exactly the time and dimensions of an eruption and most importantly, how people will react to it. Highly uncertain scientific risk scenarios can be surpassed by social, economic, cultural and personal interests.

I understood that the "discretization" and separation of facts could be seen in the proliferation of professions or fields of knowledge. In particular, I understood that professions can become the manifestation of a form of power[3] where knowledge is concentrated, exercised, and administered by a handful of privileged people who make exclusive claim to knowledge. I found out that practitioners of knowledge can become an untouchable elite endorsed by the dominant, in this case, scientific, discourse[4] toward which society must converge even while excluded from the dialogue. I learned that the emphasis of society on technical-rational knowledge "subverts the social actor's active participation in the political decision-making process by reducing all knowledge questions to issue of technique, resulting in the cult of 'the expert'" (Mumby, 1988, p.23). I realized that the exclusive reliance on science has led to a situation where the understanding of volcanic risk is often reduced to the questions of "when" and "how big" the eruption will be. I understood that the need for the continuous attempt to solve the issues of prediction and control facilitates the perpetuation of the expert. Only experts (and decision-makers as expert in the administration of community issues) are presumed to know how to tackle such issues, thus they must exist.

I realized that one of the problems in "management" of volcanic risks was the very central role that often scientists claim and play in the process of the construction of the meaning of risk. In my view now, one of the main factors responsible for people's ambivalent/ambiguous reaction toward volcanic phenomena is the existence of groups of experts and decision-makers that rule and determine in isolation the actions to follow, thereby not allowing active involvement of the community. It has been demonstrated that when things get serious, as in the case of impending or actual eruption, the problem is no longer just an "exercise on paper". Many times, reality surpasses the control of that small circle of privileged persons becoming known and perceived by the affected, with the consequent strong and confused reactions. Two months before the catasthropic eruption of Colombian Nevado del Ruiz, a map of volcanic hazards associated with this volcano was published on the front page of a national newspaper. The information presented in the map was accurate and timely. Specifically, it showed how as a consequence of an eruptive event, debris flows could be triggered covering the City of Armero. However, in November 13, 1985, about 22,000 inhabitants of this city perished under tons of debris generated after a relatively small eruption (Voight, 1990). According to Parra & Cepeda (1990), the map "was poorly understood by the authorities

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[3] And I am not referring to the idea of power traditionally associated with political parties. I am referring to Foucault's (1980) definition that power is not an object, instead it is a 'process' and 'support' where "through ceaseless struggles and confrontations" (p. 92) there is a transformation, strengthening, or reversing of the "multiplicity of force relations immanent in the sphere in which they operate and which constitute their own organization" (p.92).

[4] Where "techniques can hardly deal with real political and economical context in which social differences and inequalities are structural". (Albala-Bertrand, 1993, p.146).

and even less so by the general population, because the scientific terminology and probabilistic approach to natural hazards were unfamiliar to many of them" (p. 117). The tragedy of Armero showed how the exercise on paper elaborated by the scientists[5] --who were the only ones equipped to understand and interpret the information available[6] became an uncontrollable reality. The affected were never actively involved and this situation contributed to the communities' inaction and therefore to the well-known disastrous consequences.

I found that one possible consequence of this kind of practice is that because of an increasingly growing sophistication and fragmentation of the fields of knowledge the experts become members of specific group (e. g., the experts on volcanic risk), which with time, may have more and more difficulties establishing constructive communication with members from other disciplines and activities, including those that contribute directly to the field they are supposedly developing (e. g., geology, engineering, decision-making).

So, what to do?

Recently among experts on hazards and risk there has been a big concern about how to get the community involved in risks and hazard related matters[7]. Even though this action is driven by a good intention, it is showing that we continue talking from a privileged position. Since when did scientists have the "right" to "invite" the community to understand the problem of risk from a single perspective, in this case, the scientific perspective? In discussions with some of my colleagues, one of the observations made in regard to this question is, who then is going to report the community about any "abnormality" if not the expert? To this observation, I answer that is right; of course it is the expert who must report (providing he/she has the information). However, this must be followed by the question: What are WE going to do? (understanding we as the entire community including the expert), instead of, this is what YOU have to do.
Unfortunately, often, in addition to giving information about an anomalous situation, the expert (or decision-maker) goes beyond to indicate to the community what it must do as a response to a certain situation of risk. Beyond the recognition and acceptance of public involvement, it must be understood that it is the community itself which constructs its own meaning of risk and therefore the one "authorized" to call for the participation of

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[5] I was one of them.

[6] Unfortunately even though I was able to understand the terminology presented in the map, I never was fully convinced that a catastrophe like this could happen. In addition, as a geologist I never fully considered how important community involvement could be. I was so busy and in school I was thought that as an expert I was going to be the one in charge to tell the people what to do. Unfortunately this type of ideas are around today. Recently, while exploring the internet, under the tittle: Do you want to become a volcanologists? in the "World Volcano" page, I found (in what in my opinion is an unfortunate statement since I think they are offering a great service): "The volcanologist's work advances science, but also has direct importance to the lives of people who live near volcanoes. If a volcanologist says a volcano is not going to erupt, but it does, many people may die in the eruption. But if the volcanologist warns that it will erupt, many people will temporarily move away from their homes to safety".

[7] The issue of participation (e. g., mechanisms) has been considered by many scholars and institutions (see for example, Kingdon, 1984; Kasperson, 1986; Bradbury, 1994; Hadden, 1989; Fiorino, 1989; Lynn and Busemberg, 1995; The Institute for Water Resources (USACE), 1995; the Federal Facilities Environmental Restoration Dialogue Committee, 1993).

experts in risk, volcanologists, seismologists, etc. It must be recognized that it is the community which gives the drive for the understanding of risk.

It is important then to recognize that the principal role in volcanic risk analysis has to be shifted from the expert to the community interacting[8] with the phenomenon. It is necessary to shift to a situation where, contrary to current practices where participation is understood as the incorporation of the community into the often "frozen" and "educated" world of the experts, knowledge can be developed based on a common enterprise with no exclusive privileges for any particular group, most importantly, being conscious and responsive to the collective character of the construction of the meaning of risk. This is a situation where knowledge and/or any skill (e. g. profession) is articulated around the goals that the community proposes --a situation where, using Douglas & Wildavsky's (1982) words, "[scientists] behave much the same as other mortals" (p.61). Knowledge and skills are important and must be applied in the understanding of risk, but this must not be a reason for the privileged exercise of knowledge from where the lives of others are controlled and predicted.

I learned that even though the scientific approach was a valid way to "grab" reality, it was also important to look for other alternatives or ways of knowledge building. According to Wynne (1992), "[r]ational instrumental individualism has shown itself to be an inadequate framework for collective reason in technological and risk decision making" (p. 296). Exclusive focus on control and prediction has been shown not to solve the entire range of problems derived from the relationship between volcanoes and social structures. It is necessary to explore and exercise a form of knowledge where the field of forces generated by the process of power inherent to knowledge allows also the exercise of knowledge based on indeterminacy and paradox. Even though we have to accept that nobody knows the outcome of certain process of risk, we have to be strong in contributing to the maintainance of a transparent process of communication. A way to start this process is by openly recognizing the limitations of our knowledge and accepting the validity of what is known as popular experience. It is important to move to a situation where the importance of the expert is decentered thus giving more importance to what Bateson (1993) calls the "canon of human experience". A situation where the awareness and the experience of living the process of construction of risk meaning is at least as important as the current and dominant wish (and/or controversy) for ways to represent the perception of risk.

It is also necessary to recognize that more important than the paradigms, methods or disciplines we use to construct knowledge (in this case, the understanding of the process of risk), is the "politics" associated with the particular exercising of knowledge. I used to associate politics with presidential elections, decision-making or debates over policies. However, I learned that politics is more than that. I learned that any kind of factor capable of producing a mobilization of resources and having the ability to fix meaning that serves more the interest of one group (or individual) over another, is

[8] Watts (1983) refers to society and nature as a unity. For this author, instead of interaction between society and nature, there are "*inneractions* shared between humans and nature" (p. 234), all happening within an internally differentiated nature

political. Processes or faculties like meaning, experience, perception, and identity, become political (see Deetz, 1992).

With respect to knowledge, in particular, I learned that the "knowledge claimed in every day life --in its institutions of science, commerce and religion --as well as knowledge about knowledge claims in every day life are politically loaded" (Deetz, 1992, p. 78). As I mentioned before, by reducing all knowledge questions to the issue of technique, the social actor's active participation in the political decision-making process is subverted. For both experts and the community, it is important to understand how the construction of knowledge is exercised and how the resources derived from it are allocated. It is necessary to shift to a situation where the people involved recognize their power and mobilize those resources present in knowledge, beliefs, culture, and perceptions in everyday activities. The problem may not necessarily be the method nor the paradigm used in the construction of knowledge: the problem is how the resources derived from that practice are allocated --not "politics" itself, but rather how it is exercised.

Certainly more new ideas must be explored. The application of the scientific method not only has to continue but has to be encouraged, but, recognizing a participative situation not only in the process of decision-making but in the very process of building knowledge. We not only as professionals, but also as members of the community, have to be ready to report to the community any circumstance that can significantly influence the process of risk. However, it is the community itself (which include the experts) that must take charge of understanding and assuming the responsibilities derived from the experience of risk. Under these circumstances, it is clear that it is the awareness on behalf of the community that they are living a process (the process of risk) that will create the conditions that will allow for an adequate management of volcanic risks and hazards. Having had the experience of being in several volcanic crisis situations, I understand that this may sound idealistic since its implementation seems to be a difficult task. However, this way of thinking that has been around for some time seems to offer possibilities that need to be explored and exercised. It may take several generations, that is why we have to start now.

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Mammoth ski resort hopes volcano alert won't rattle clients

By Steven J. Gorman
Daily News Staff Writer

A flurry of more than 100 small earthquakes near the eastern Sierra ski resort of Mammoth Lakes has prompted government scientists to issue a volcano alert just before the start of a major holiday weekend.

But scientists at the U.S. Geological Survey said there is no sign of an imminent eruption, and tourism officials expressed confidence the alert would keep away few if any of the 20,000 visitors expected in Mammoth Lakes for the three-day Presidents Day weekend. The resort area is 250 miles north of Los Angeles.

"I was here, and I never felt anything," said Ralph McMullen, tourism director for the Mammoth Lakes Visitors Center. "We always get a few panicky phone calls, but we let them know we're alive and well."

He said lodging in town is so overbooked that some visitors have been sent to motels as far as 100 miles away.

The "Level D" volcano alert issued Thursday "denotes weak to moderate unrest" in the area around Mammoth Mountain, a volcano that last erupted at least 550 years ago, said Malcolm Johnston, a geophysicist with the USGS office in Menlo Park, south of San Francisco.

"That's a pretty low level of alert," he said. "I don't think there's a real cause for concern."

Johnston said the alert will remain in effect at least through Monday.

A Level D alert — the second lowest of five stages of a volcano warning system (with Level A the highest) — has been issued at least five times since a series of strong earthquakes struck the area in May 1980, Johnston said. The last one was more than a year ago.

Apart from being Southern California's premier ski destination, the Mammoth Lakes area also is considered the hottest volcanic zone in the lower 48 states, even more restless than Mount St. Helens.

"Mammoth Mountain is a volcano," Johnston said. "It's not dormant, but it's not active. It's somewhere in between."

This week's subterranean rumblings occurred at the edge of a 9-mile-wide, 19-mile-long sunken area scientists call the Long Valley Caldera, the remnants of a crater left over from a catastrophic volcanic eruption 700,000 years ago. That blast is believed to have been 600 times more powerful than the Mount St. Helens eruption in April 1980.

The Mammoth Mountain ski resort faxed a statement to ski shops throughout Southern California on Friday seeking to allay concerns about the alert.

"People have been calling, and of course they have questions about what has been printed and what's been said," resort spokeswoman Wendy Kelley. "And we're reassuring them this is normal for this area. There's nothing to be alarmed about. And it shouldn't ruin their vacation plans."

McMullen said no one in town is worried about a drop-off in business.

"We're having a hard time figuring out where we're going to put them," he said of the crush of skiers expected. "This is the biggest weekend of the year outside Christmas."