THE ROLE OF SCIENCE AND INDEPENDENT RESEARCH DURING VOLCANIC ERUPTIONS

INTRODUCTION

The recent article in the *Bulletin of Volcanology* on Professional Conduct of Scientists During Volcanic Crises prompts our concern that the role of scientific inquiry and data gathering during volcanic eruptions was not adequately emphasized in this manifesto for volcanological observatories. Also, the contributions, rights, and roles of scientists who are not affiliated with the hazards team were unjustifiably, and perhaps unintentionally, slighted. The contribution focuses on the management aspects of volcanic crises (which are certainly very important) but neglects the unequaled scientific opportunities that eruptions present. We believe that the document is potentially divisive, portraying outside scientists as burdensome to the hazards team when, in fact, both hazards evaluation and research science are of the utmost importance during an eruption and both need to be promoted. The members of IAVCEI should critically evaluate this new code before it becomes the *de facto* constitution of our profession.

Many of the recommendations of the crisis protocol subcommittee are self-evident, especially that during volcanic crises scientists must act civilly and responsibly and be aware of potential problems in communicating with other scientists, public officials, and the press. Scientists working on their own research need to recognize the different priorities of the hazards team and do everything within reason to cooperate with them. The clauses addressing communication, civility, and leadership are well supported by the evidence of case studies in the References, so the reader is able to study examples of why such behavior is important.

Other parts of the protocol are far less obvious or are not backed up by the evidence of experience or that presented in the References. One has the sense that some of the generalities are based on isolated instances that may have been rooted in personality conflicts. Many of these clauses are refutable, and others are so vague that they are impossible to assess critically, owing to the lack of specific examples justifying the rules put forth. Such non-consensual and vague clauses should have not have been included in the protocol. Rather than digressing into a point-by-point argument, we prefer to focus on a few central issues that are critical for *promoting* science at volcanic eruptions, which we believe was under-emphasized in the document

1. ERUPTIONS ARE THE PRIMARY VENUES FOR GATHERING DATA ON VOLCANIC PROCESSES.

Eruptions present the most important opportunity to gather data on the basic processes of volcanology: they are the ultimate trial for hypotheses developed by study of ancient volcanoes or modeling. Many volcanological, geophysical, geochemical, and petrological techniques require real-time data gathering during an eruption that may not have direct applicability to the hazard at hand. Therefore, *promoting all possible* scientific inquiry must be a major part of any strategic plan for managing volcanic eruptions. As pointed out in the guide under "Leadership problems" but neglected elsewhere, those who manage scientific teams during eruptions need to appreciate the legitimate role that scientific research by many investigators can and must play in better

understanding and predicting volcanic eruptions. The payoff of such research will be a long-term reduction of hazard on a worldwide basis.

2. THE IMPORTANCE OF SERENDIPITY IN SCIENCE AND THE NEED FOR OPEN SCIENTIFIC OPPORTUNITIES DURING ERUPTIONS

As important as foresight and strategic planning are to developing a hazards assessment, one cannot predict or even anticipate where or when new scientific discoveries will be made. Many important discoveries based on observation of natural phenomena are the result of converging fortuitous events. Thus, it is not possible for managers of volcanic eruptions to know in advance which scientific studies will lead to new insights into volcanic processes. The future of the science, including hazards work, depends on study of eruptions by as diverse a group of scientists as possible.

The 1980 Mt. St. Helens experience is perhaps the best-known example of this contention. Much of what we now know about the sector collapse came from scientists unaffiliated with the hazards team and observations and photographs of non-scientists. These "accidental" observations initiated recognition of giant avalanches and debris flows as a major hazard and revolutionized hazards assessments on a worldwide basis.

The requirements of the crisis protocol that projects be approved prior to an eruption, that funding by independent agencies be tied to permission of the hazards team, and that an 'enthusiastic' response be received to a request for participation during an eruption are unreasonable expectations. Further, they may work against the hazards assessment by removing different expertise and diverse views. These requirements also assume the managers of the crisis team would understand the details of all studies to be conducted on volcanic eruptions. Managers or members of the crisis team should not be put in the position of judging the merits of scientific studies, just as people involved in the basic research do not play a leadership role in the crisis management.

Mangers of volcanic crises must be prepared for scientists who want to perform scientific investigation during an eruption and plan in advance how to accommodate them, and that ideal should have been a focus of the document. Clearly, the community needs to design a balance between the short-term goals of the hazards team and the longer-term goals of research scientists, and both parties need to work to promote and support the work of the other.

3. WHAT EXACTLY IS A “CRISIS”?

Part of our concern stems from the poor definition of what exactly constitutes a 'volcanic crisis': are all eruptions 'volcanic crises', or must lives be at risk to qualify for this status? It is conceivable that the code of conduct might be used to exclude scientists who have a legitimate reason for being at an eruption, for personal or political reasons, not for safety or hazards concerns. If all eruptions are to be covered by the recommendations of this professional conduct code, then the role of observation, inquiry, and data-gathering by all investigators at volcanic eruption requires clarification.

4. THE BENEFITS OF DIFFERENT POINTS OF VIEW

In several places, the article alludes to suppression of outsiders' opinions if the their views do not happen to coincide with those of the crisis team and its leader, not only to the public and press but also to other scientists and funding agencies. The vast

majority of scientists would disagree with censor in these forms, with the belief that free inquiry, free speech, and debate is the most likely path to solving any problem, including the processes associated with an eruption. Inclusion of knowledgeable research scientists in the discussions of the hazards team is clearly desirable, as different expertise and a different perspective may be brought to a crucial issue or unforeseen outcome.

Dealing with the public and press brings about its own special problems that most volcanologists recognize. Clearly, scientists who are not directly involved with the crisis team should not be issuing predictions or warnings. However, much opportunity to educate arises with each eruption, and volcanologists should promote awareness and understanding of volcanic phenomena and their hazards even if they are not part of the hazards team.

In summary, we believe that the article outlining professional conduct during volcanic crises contains some ideas that, if adopted, would hinder the long-term goals of both the science of volcanology and efforts at crisis management. Members of IAVCEI should review this article carefully and ponder its potential impact on the field of volcanology. Instead of being an ends, the conduct guidelines serve as a starting point for discussion among the volcanological community as to how to best balance the responsibilities of those involved in hazard assessment and those in scientific pursuit. There is, after all, the common goal of understanding all phenomena associated with volcanic events and using that to decrease risks to life and property.