VOLCANO HAZARDS FACT SHEET

U.S. Department of the Interior
U. S. Geological Survey

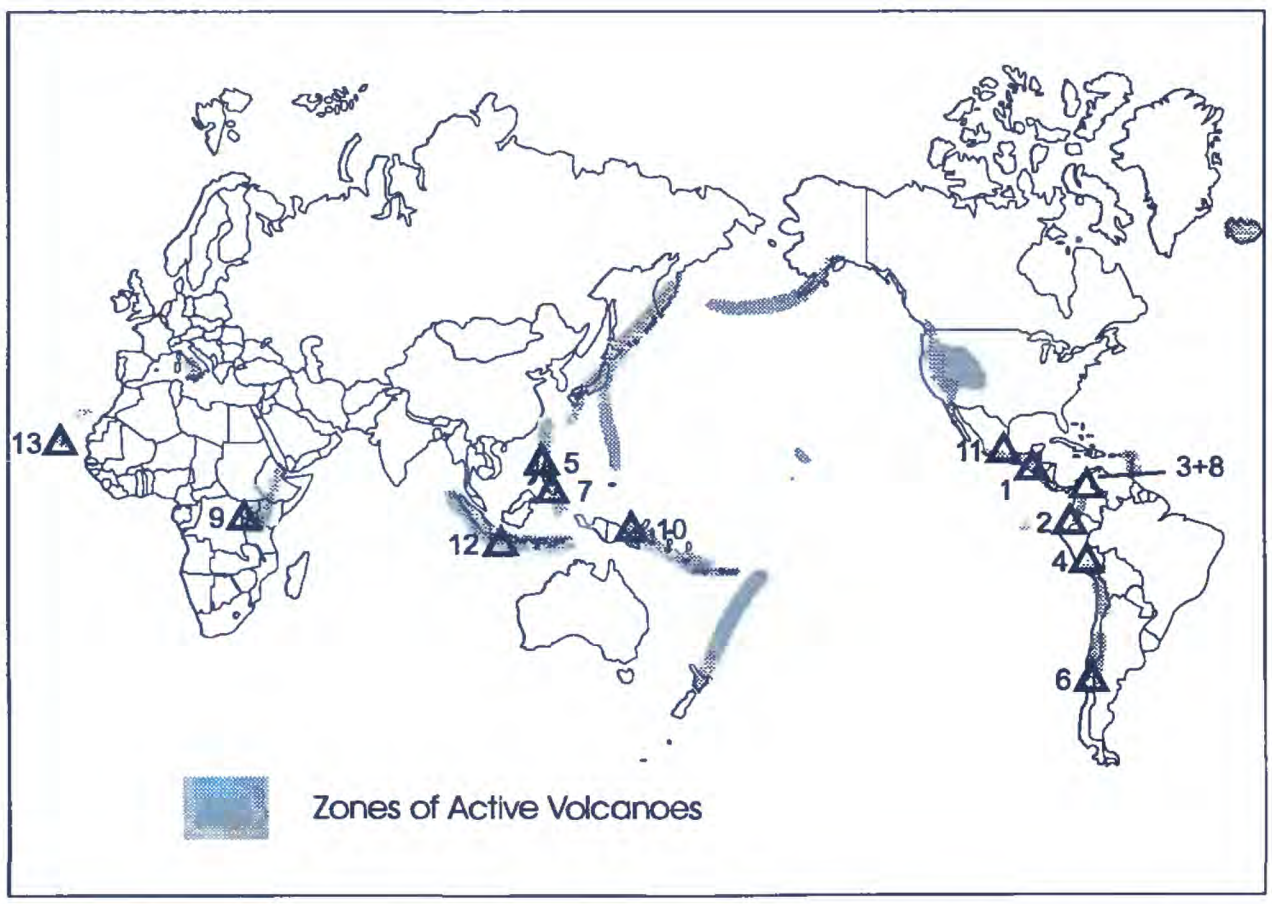
The USGS/OFDA Volcano Disaster Assistance Program

Introduction

An erupting volcano is one of nature's truly spectacular sights. From a distance, or perhaps through the cameras of the news media, we often observe roiling mushroom clouds of ash or flows of incandescent lava issuing from the volcano's throat. If, however, you happen to live near that erupting volcano, your life or livelihood may be endangered and your property at risk of destruction—a spectacle of power and beauty may become one of fear and devastation. To help mitigate the effects of volcanic eruptions around the world, the U.S. Geological Survey (USGS) and the U.S. Agency for International Development's Office of Foreign Disaster Assistance (OFDA) have developed the Volcano Disaster Assistance Program.

Impact of Volcanic Eruptions

The decade of the 1980s and the first half of the 1990s was a period of frequent destructive volcanic eruptions. During the past 15 years volcanic activity killed more than 29,000 people, forced over 830,000 to flee from their homes, and caused economic losses in excess of $ 3 billion (Simkin and Siebert, 1994). As rapidly growing populations in both developed and developing countries encroach on areas of high volcano hazard, the potential for volcano-related casualties will increase. Worldwide, more than 1500 volcanoes have erupted in the last 10,000 years, and about 630 of these have erupted in historical time (Simkin and Siebert, 1994). On average, about 50 volcanoes erupt each year; of these, about a dozen cause appreciable damage and may cause human casualties. Several times a decade, volcanic eruptions cause major damage and disruption and kill many people.



Principal volcanic regions of the world. Numbers indicate volcanoes to which VDAP has responded recently with monitoring assistance, hazards evaluation assistance, or both. 1-Pacaya Volcano, Guatemala, 1987; 2-Guagua Pichincha Volcano, Ecuador, 1988; 3-Galeras Volcano, Colombia, 1989; 4-Sabancaya Volcano, Peru, 1990;5-Mount Pinatubo, Philippines, 1991-94; 6-Hudson Volcano, Chile, 1991; 7-Mayon Volcano, Philippines, 1993; 8-Huila Volcano, Colombia, 1994; 9- Nyiragongo and Nyamuragira Volcanoes, Zaire, 1994; 10-Rabaul Caldera, Papua New Guinea, 1994; 11- Popocatepetl Volcano, Mexico, 1994-1995; 12- Merapi Volcano, Indonesia, 1995; 13- Fogo Volcano, Cape Verde Islands, 1995.

Development of VDAP

Following the tragic 1985 eruption of Nevado del Ruiz Volcano, Colombia, in which over 23,000 people lost their lives, the USGS and OFDA began the Volcano Disaster Assistance Program (VDAP). The primary mission of this interagency cooperative program is to reduce eruption-caused fatalities and economic losses in developing countries. The principal components of VDAP are operational funding from OFDA, a small core group of scientists at the USGS' Cascades Volcano Observatory (CVO) in Vancouver, Washington, a large group of contributing scientists from CVO and other USGS offices, and a cache of portable volcano-monitoring equipment ready for rapid deployment.

The strategy employed by VDAP to reduce loss of life and minimize economic disruption includes instrumental monitoring to detect the movement of *magma* (molten rock) toward the surface and thereby forecast eruptions, and assessments of volcano hazards and risk based on past eruptive events at a volcano.

Installing a seismic station as Mount Pinatubo fumes in the background. A USGS/PHIVOLCS team installed volcano-monitoring instruments in the weeks before the climactic 1991 eruptions. This was one of several seismic stations that provided data which were critical in assessing the volcanic hazards and eruption threat of Mount Pinatubo.

A great majority of the world's potentially active volcanoes are unmonitored. Less than twenty-five percent of volcanoes that are known to have had eruptions in historical time are monitored at all, and, of these, only about two dozen are thoroughly monitored. Moreover, seventy-five percent of the largest explosive eruptions since 1800 occurred at volcanoes that had no previous historical eruptions (Simkin and Siebert, 1994). Thus, until regular volcano surveillance is much more widespread, a mobile crisis-response capability is needed to quickly assess hazards and install monitoring equipment when a volcano becomes restless. Otherwise, tragedies like the one at Nevado del Ruiz will be repeated.

Mobile Volcano Monitoring System

Recognizing that many potentially dangerous eruptions will occur at un-monitored or under-monitored volcanoes, the USGS has developed a mobile volcano-monitoring system which includes instrumentation to monitor seismicity, ground deformation, certain volcanic gases, and debris flows (Ewert and others, 1993). Also included in the cache are weather radar and microbarograph instruments to detect eruptions at times when darkness or inclement weather hide the volcano.

The technologies developed and experience gained by the USGS in other countries also help prepare the USGS for future eruptions in the continental U.S. and Alaska. The recent success of the VDAP team in minimizing loss of life and property during the 1991 eruption of Mount Pinatubo, Philippines, illustrates the capabilities of the VDAP. Locations of other recent VDAP responses are shown on the map.

Response to Mount Pinatubo

In April 1991, following steam explosions and earthquakes at Mount Pinatubo, VDAP helped the Philippine Institute of Volcanology and Seismology (PHIVOLCS) to assess and forecast volcano hazards at Mount Pinatubo. The VDAP team also provided critical advice to the U.S. Air Force at Clark Air Base and the U.S. Navy at Subic Bay Naval Station. The joint Philippine-U.S. team worked quickly to install monitoring equipment, to conduct reconnaissance geologic mapping and dating studies to better understand Pinatubo's eruptive history, to prepare a preliminary hazards-zonation map, and to educate and alert the population at risk. Timely warnings issued by the PHIVOLCS-VDAP team—combined with effective communications between the scientists, emergency-management officials, military commanders, and the public—enabled the safe evacuation of at least 58,000 people prior to the volcano's climactic eruption on 15 June 1991. The successful response to the Mount Pinatubo eruption validated the VDAP mobile-team concept: A rapid response team such as the VDAP *can* be deployed in time to significantly assist a country to mitigate risks associated with a major volcanic eruption, saving both lives and property.

Since the 1991 eruption of Mount Pinatubo, VDAP has responded to other volcano crises in Mexico, Papua New Guinea, the Cape Verde Islands, and Indonesia.

John W. Ewert and C. Dan Miller, June 1995

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