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IDNDR PROPOSAL

VOLCANIC HAZARDS
CENTRO ANDINO DE VOLCANOLOGIA - CAVOL

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Introduction

Latin America and the Caribbean region contain six volcanic chains (Fig. 1) which include more than one hundred volcanoes that have erupted in recorded history (Tilling, in press). Many of volcanoes are located near high-density populated areas. Projections of world population growth show that populations in developing regions, such as Latin America, will expand much faster than in industrialized regions, and most of the projected growth will occur in already densely populated urban areas.

Volcanoes in Latin America have been responsible for about a quarter of the world's eruption-caused fatalities since the year 1600 (Sigurdson and Carey, 1986). It is even more sobering to note that in the 20th century more than 80% of the world's fatalities from volcanic activity were caused by eruptions in four of Latin America's volcanic chains: Trans-Mexican, Central American, Colombia - Ecuador, and the Lesser Antille. The number of eruption caused deaths during the three centuries from 1600 through 1899, excluding famine and disease, was about 90,000 to 100,000, an average of 320 per year. During the present century through 1990, the total number of deaths is close to 80,000, - an average of 880 per year, or more than 2 1/2 times higher than during the preceding three centuries.

Given the advances in volcanology in this century, the above figures point to a rapidly growing problem. It is quite evident that gains in hazards mitigation from scientific and technological advances (mostly confined to the developed nations) are offset by the explosive growth of populations, as in Latin America. Other factors are:

- Reliable short-term forecasts still are not possible for most volcanoes.
- Virtually all of the fatalities in the 20th century are caused by flowage hazards associated with explosive eruptions. Volcanic-hazard mitigation, including monitoring and hazards-assessment studies are inadequate because of insufficient funds and trained personnel.
- The most dangerous volcanoes are the least understood and studied; most of them are in developing countries.
- Advances in monitoring, eruption forecasting, and hazards assessment have not been incorporated into effective volcanic emergency planning and management.

- Significant volcanic-hazards mitigation cannot be achieved by science and technology alone. Needed are improved communications with government officials; properly interpreted data must be communicated to emergency-management authorities in a manner readily understood.
- Given the fact that scientific information is still not specific enough about the time, place, nature, and size of an anticipated eruption, to compel officials to take action, the messages from the scientists must be consistent, clear, convincing and credible.

International programs

The development of international programs needed to cope with the increasing problem of volcanic hazards in Latin America and other developing regions is an urgent challenge to both the scientific community and the decision making bodies. Volcanic crisis must be prevented from turning into volcanic disasters.

"The IDNDR program, though still not fully funded or operational, provides a timely framework to augment global volcanic hazards mitigation" (Tilling, in press).

In the short term the developed countries need to boost their technical assistance through bilateral or international programs until the developing countries attain self-sufficiency in volcanology (Tilling, 1989b, p. 263). But self-sufficiency will be realized only in those countries committed to develop a national will to address the problems of volcanic hazards. An assistance program will accomplish very little if counterpart support is lacking or only symbolic.

Funding agencies must be persuaded to use available monies, however modest in amount, to fund specific studies at high-risk volcanoes in developing regions. High priority should be placed on the preparation and dissemination of general interest publications to educate officials and the general public.

Future advances in volcanic-hazards mitigation Latin America will best be realized if the affected countries can achieve self-sufficiency, but this goal may require, in many countries, years to decades. Meanwhile, international and bilateral funding agencies are requested to consider implementation of programs stably funded for a long term. Such programs should encompass activities before any volcanic crisis arises, mutual assistance between countries and a rapid response capability during volcanic crises.

CAVOL proposal*

CENTRO ANDINO DE VOLCANOLOGIA

"The Volcano EARly Warning Disaster Assistance Program (VDAP) and the Volcano Crisis Assistance Team (VCAT) are programs that have been assisting Latin American scientists and civil defense personnel to become self sufficient in mitigation and management of geologic hazards with particular reference to volcanoes. With the Centro Andino de Volcanologia (CAVOL), we are seeking to continue the successes in hazards mitigation in South America made after VDAP's formation following the tragic eruption of Nevado del Ruiz in 1985, which resulted in the loss of over 26,000 lives. We anticipate that successes and learning experiences associated with establishment of an independent CAVOL would form the pattern that will assist donor and developing nations to more efficiently establish additional regional hazards mitigation centers in other areas of the world with similar high risk to volcanologic and other geologic hazards."

"Background.- Centro Andino de Volcanologia (CAVOL) was proposed in 1988 by the Volcano Early Warning and Disaster Assistance Program (1986-1991), which financially assisted CAVOL's organization and some initial operations in 1989-90. Conceptually, CAVOL is similar to VDAP, which, through a funding agreement between the US Geological Survey (USGS) and the US Department of State's Office of Foreign Disaster Assistance (OFDA), maintains a core group of scientists and technicians (VCAT) who develop and maintain a mobile cache of volcano monitoring equipment, target and evaluate the hazards from high-risk volcanoes, establish baseline monitoring networks, respond to volcano unrest, generate and expand inter- and intra-country scientific and civil defense liaisons and cooperation, provide training and educational services, and generate scientific and logistical databases that promote effective mitigation of potential hazards from future eruptions in the Latin American and Caribbean region. Because of considerable overlap of geologic processes and scientific technology, VCAT/VDAP's assistance in volcanology also improved national efforts in the fields of earthquake, landslide, and flood hazards."

"VDAP's effectiveness is perhaps best demonstrated by the fact that 7 new and viable observatory groups were established in Latin America in 1986-1990, most of the pre-existing groups were appreciably upgraded, and most

* (From working document prepared by Norman Banks (USGS), Minard Hall and Patricia Mothes (Inst. Geofisico - Quito) and John Toehlin (UNESCO), Oct. 1990.)

significantly, now VDAF-assisted latino volcanological groups are handling volcano crises internally (Ruiz and Galeras by Colombia in 1989; Fichincha by Ecuador in 1988 and 1990) and cooperatively (Galeras-Colombia 1989; Sabancaya-Peru-1990), with assistance, not lead, being provided by developed countries. This progress toward national and regional independence included introduction by VDAF of proven and standardized instrumentation and monitoring techniques that could be assimilated and supported regionally without overwhelming the resources and capabilities of the recipient. The progress also required follow through and follow up by VDAF so that instrumentation and techniques were maintained and upgraded rather than forgotten and abandoned by the US after initial implementation."

"Despite success, it became apparent by the second year of VDAF operation (1987) that provision of hazards mitigation assistance to all of Latin America was too large a task in relation to VDAF's staffing and funding levels. There was, in effect, a continual doubling problem in support needs that paradoxically came with the increase in number of new and improving hazards mitigation groups. Therefore, to maintain quality assistance, VDAF proposed CAVOL as the solution to regional needs in training and program development. The alternative to this channeling and concentration of outside assistance through CAVOL was the continued dilution of assistance through increasingly duplicated activities throughout Latin America. CAVOL, by being multinational, offered the additional advantages of widening the spectrum of potential donor nations, of improving cooperation between the several donor nations working within the region, and of more effectively promoting regional standardization of techniques and equipment for better inter-regional cooperation and assistance during volcano crises."

"CAVOL.- CAVOL took a step toward realization through an organizational meeting convened by VDAF in Pasto, Colombia, in May 1989. There, scientists and civil defense personnel from all 6 South American nations formulated CAVOL's general organizational/operational character and signed a letter of intent to continue its development. The Instituto Geofisico (IG) in Quito, Ecuador, was chosen as the first host institution, and Norman Banks (VDAF's Program Chief) was authorized to negotiate with US and international groups on behalf of the organizational group. IG's parent university subsequently offered to provide space to house the center, and USAID-Ecuador provided funding for an on-progress feasibility study of CAVOL. Assurance of regional participation and encouragement of even distribution of CAVOL activities were to be assisted through maintaining a NSF-like review board composed of volcanologists and civil defense personnel of member and participating nations that

solicit, review, and recommend enactment of CAVOL projects." "We stress that it is important that CAVOL benefits from the lessons and years of VCAT/VDAP operational experience. When compared to the ad hoc operation of VCAT 1981-1985, it is certain that the major factor contributing to VCAT's increased rate of progress in 1986-1990 was the addition of VDAP's stable funding which provided long-term core, rather than rotating, staff and continual, in addition to crisis, operations. This stability of staff and operations allowed consistency in program activities and accelerated problem solving as the staff gained needed familiarity and experience through reiterative interaction with recurring obstacles. For similar assured progress and consistency of goals, CAVOL will likewise require stable funding and a long-term core staff. In addition, because of their experience with VDAP and other successful as well as unsuccessful assistant programs, all Latin American colleagues have forcefully argued that CAVOL must have a strong, full-time professional link with at least one donor nation. As a case in point, IMCWS (International Mobile Earth, Warning System, UNESCO, 1984) is similar in concept to VCAT/VDAP and has identical objectives; however, 6 years after it's being proposed, it has not come into effective existence because of lack of stable funding and long-term core staff that sets program goals and assures their completion in accordance with consistent and reiterative interaction with the developing institutions."

Budgets and staff.- If patterned after VDAP, which has been successful, CAVOL should have a minimum yearly budget of \$500,000 (equal to that of VDAP). This level of funding would continue development in the region at about the same moderate level as was done with VDAP. Ideally, the yearly budget should exceed \$2,500,000, a level that would provide the resources necessary to generate effective program acceleration and appropriate opportunity for and advancement of personnel through education, exchange programs, and training. This more productive level of funding is totally justified because of future savings in effective regional independence, in more assured mitigation of disasters, and in positive feedback to the hazards programs of all donor nations. Moreover, it would demonstrate within a highly visible forum that the donor nations are in South America as partners, not there to exploit opportunity or to make late awards for failed mitigation of forecastable disasters. However, several minimal configurations are possible that could vary the budget downwards and perhaps still result in a CAVOL considered to be useful by Latin Americans. One such minimal configuration generated out of meetings in Pasto, Quito, CVO, and Reston is:

REGIONAL CENTER

DONOR NATION (S)

STAFF

Coordinator (preferably a volcanologist)	Coordinator Volcanologist
Electronics Engineer	Secretary/Purchasing Agent
Electronics Technician	
Secretary	
General Assistant/Driver	General Assistant

FACILITIES

2 Offices and Furniture	
1 Laboratory and Furniture	
1 Large storage room	
1 vehicle	
Electronic testing and development tools	Supplementary Electronics
Mobile equipment cache	Supplementary Equipment
Travel funds	Travel Funds
Workshop funds	Library acquisition funds"

"This configuration would assure that the national program of the host institution will not be negatively impacted by the additional burdens of CAVOL; supplementary technical and funding support from the donor nation(s) and the member nations for crises, workshops, and special projects is assumed. Hopefully, both the baseline and the supplementary support would come from a variety of national, regional, and international sources. Some operations could also be coupled to UNESCO-IMEWS, the International Decade for Natural Disaster Reduction (IDNDR), and various bilateral activities such as USGS/OFDA VDAF."

"Activities.- Some of CAVOL's projected activities and goals are:

PUBLIC EDUCATION

OUTREACH TO AND EDUCATION OF CIVIL DEFENSE, PUBLIC OFFICIALS, AND THE MEDIA
COMMUNICATION

- E-Mail and satellite communication
- Annual meetings
- Newsletters/Bulletins
- Cross fertilization visits between groups

TRAINING

- Scholarship funds for higher education
- Workshops—scientific and application
- Translation of manuals and benchmark articles and textbook
- Educational and training videos and manuals
- Visiting expert programs

Exchange programs
International publication/meeting participation support
HAZARDS AND RISK EVALUATION
BASELINE MONITORING AND ERUPTION EARLY WARNING
EQUIPMENT/TECHNIQUE
DEVELOPMENT/MAINTENANCE/STANDARDIZATION
CRISIS RESPONSE
BIBLIOGRAPHIC REFERENCES/LIBRARY

Naturally, the number and depth of the activities realized in any given year would depend upon the available operational support and staff."

"Concluding comments.-

The need and potential achievements of CAVOL have already been demonstrated through almost 5 years of operation of VDAF in Latin America. VDAF also provided, through practical operation, a successful design and experience that can be applied to maximize future advancement and minimize avoidable mistakes. Success with, and lesson from, CAVOL would be directly applicable to the IDNDR and would benefit development of regional and national centers in other high-risk volcano zones while simultaneously assuring self-sufficiency necessary for effective volcano and other hazards mitigation within South America. In the long term, an effective CAVOL will allow fuller reprogramming of donor country expenditures to other areas of donor-country domestic and international concerns, and this reprogramming will undoubtedly be assisted by the contributions, experience, and scientific advances that come from partnerships developed through and within CAVOL."

Role of CERESIS

Consideration of a host institution for CAVOL involves several factors. A mission organized by Norman Banks (USGS) visited Argentina, Bolivia, Chile, Colombia, Ecuador and Peru. Its report on relative capabilities and present programs, experience, existing instrumentation, trained personnel, the relevant institutions that expressed interest in hosting CAVOL, and additional information are available from UNDRR.

The six Andean Countries involved are members of the Regional Center for Seismology for South America - CERESIS. CERESIS (see brochure) is a regional organization established by the governments of 11 nations. Its Governing Council is constituted by the official government representatives (earth scientists and engineers) of the member States. The Executive Director's Office is under the authority of the Council. Council meetings are held in the several member states, the Executive Office is located in Lima, Peru.

Regardless of where CAVOL may be located, the CERESIS Council has expressed its willingness to act on behalf of the Andean countries to provide CAVOL with the benefit from 20 years of experience in multinational programs, the official privileges which the member States accord CERESIS, as an inter-governmental international organization and a established administrative and management structure. The submission of this proposal by CERESIS, expresses the interest of the organization to fully support the CAVOL concept favoured by UNDPD and the USGS, with its experience and capabilities, regardless of the location of the operational rapid-response component. CERESIS, as an official regional body, is well suited to serve CAVOL, a regional program which falls within the scope of CERESIS. In 1987, the CERESIS Governing Council approved modification of its Statutes to explicitly include volcanology and volcanic hazards.

Budget estimates range from half a million to two and a half million dollars per year. However operational costs will depend largely on the level of contribution from the host institution and the possible transfer of equipment from OFDA/AID to CAVOL. A modest beginning with a reduced program of projected activities may be recommendable; at the same time it will translate into a smaller budget. It is important to take action to establish CAVOL and to commit long term funding, recognizing that as CAVOL grows roots and acredits itself, additional funding can be expected.

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Fig. 1 - Latin America and Caribbean volcanic chains