Agreement

Instituto Nicaragiense de Estudios Territoriales (INETER), Managua, Nicaragua
and
Forschungszentrum für marine Geowissenschaften (GEOMAR), Kiel, Germany
agree a cooperation in the field of
“Causes of Volcanic Eruptions, Earthquakes and Climatic Changes in Nicaragua
and Central America, and Volcanic Hazard and Volcano Monitoring System in
Nicaragua”
through the research projects
SFB 574 “Volatile fluids in subduction zones: Climate feedback and trigger
mechanisms for natural disasters”
and
VW foundation “Gas emissions into the atmosphere along subduction zones”

The understanding of seismic and volcanic disasters and the climatic impact of
subduction processes require complex scientific investigations of these phenomena. The
basic research of these processes may improve the efficiency of monitoring and early
warning systems and other technological and organizational measures which help to
reduce and mitigate the effects of natural disasters. This cooperation agreement,
important for the understanding of the causes of the volcanic, seismic and tsunami
hazards and the development of early warning systems in the Nicaraguan Pacific Region,
is divided in two parts:

PART 1: GEOMAR in cooperation with INETER carries out investigations in
Nicaragua, in the Pacific Ocean offshore Nicaragua, and in cooperation with institutions
from Costa Rica in the border area of this country. The aim of this work is to obtain
seismic, geological, geophysical and vulcanological data of this region and to develop
new scientific models. Parts of the bathymetry of the large lakes in Nicaragua and of the
ocean bottom will be mapped. This work is part of an ongoing international cooperative
effort to understand the mechanisms of tectonic plate subduction, the generation of
earthquakes and tsunamis, the role of submarine avalanches, the explosive volcanism in
Nicaragua and the similarities and differences to corresponding processes in Costa Rica.

GEOMAR informs INETER regularly about the preliminary and final results of
this research, in form of internal reports and special scientific publications. INETER
scientists are invited to participate actively in the investigation process and in the
publication of results. Scientists from INETER will be granted access to data and results
that could be important for the volcanological research, volcanic hazard maps and volcano monitoring in Nicaragua (e.g. topographic data of large lakes). GEOMAR helps in scientific advising for the development of the Nicaraguan Volcano Monitoring System.

The details of the studies programmed for this part of the cooperation project are presented in detail in the formal proposal to the German Ministry of Research and Technology where the INETER participation is mentioned.

INETER will provide logistic support for these GEOMAR activities in Nicaragua.

**PART 2: INETER, supported by GEOMAR, will improve its monitoring system for the active volcanoes in Nicaragua.** The recent volcano monitoring system is mainly based on seismic data. INETER will introduce the monitoring of volcanic gases in fumaroles in the active craters and other sites as a new component of the volcano monitoring system. The methodology for routine gas measurements will be developed and a routine monitoring program will be carried out. Measurements of volcanic gases studies will be carried out. INETER scientists together with experts from GEOMAR will test new methods and introduce the most efficient ones to the routine monitoring practice.

Additionally, INETER will introduce other methods for an efficient volcano monitoring program. GEOMAR scientists cooperate in this part of the project and requests for scientific advice will be directed to GEOMAR. GEOMAR scientists will carry out training "on the job" for INETER personnel working on volcano monitoring, especially in the field of gas sampling and analytical techniques.

Results of the first part of the project will be used to improve the geological and volcanic hazard maps of Nicaragua.

INETER will provide logistic support for the corresponding GEOMAR activities in Nicaragua.

**TIME FRAME :** The project will be executed in the years 2002-2004.

**FUNDING :** For this project GEOMAR obtained the amount of **4,736,000 US$** through the SFB 574, as well as about **6,000,000 US$** for ship expeditions funded by the Ministry of Research and Technology of the Federal Republic of Germany. Additional funding of **90,000 US$** was obtained from Volkswagen Foundation/Germany. Thus, the total sum of almost **11,000,000 US$** (eleven million US dollars) will be spent for this project. These funds are fixed operational costs for research vessels, for scientific expeditions to Nicaragua, for laboratory work, for computing facilities, and for personnel at GEOMAR. These funds will also be used to cover the partial costs for chemical laboratory and computing equipment to be donated to INETER (through the VW project) for the volcanic gas monitoring system.
INETER will request additional funding by the Nicaraguan government to be used for the development of the volcano monitoring system. The details of the project will be presented in a formal project proposal directed to the government of Nicaragua.

Prof. Dr. Wolf-Christian Dullo  
Director  
GEOMAR Forschungszentrum  
für marine Geowissenschaften  
Wischhofstraße 1-3  
D-24148 Kiel/Germany

Ing. Claudio Gutiérrez  
Executive Director  
INETER  
frente a la Policlínica Oriental  
Managua, Nicaragua

June 26, 2002