

HYDROLOGICAL CHARACTERIZATION OF THE VALERA TERRACE (VEN/8/012) F4

New

MODEL PROJECT

CORE FINANCING

YEAR	Experts		Group Activity	Equipment	Fellowships		Scientific Visits		Group Training	Sub-Contracts	Misc. Comp.	TOTAL
	m/d	US \$	US \$	US \$	m/d	US \$	m/d	US \$	US \$	US \$	US \$	US \$
1999	1/0	14,700	0	35,000	0/0	0	0/0	0	0	0	0	49,700
2000	1/0	15,450	0	40,000	6/0	21,600	0/0	0	0	0	0	77,050

First Year Approved: 1999

OBJECTIVES: Development objectives: To develop a problem solving methodology for unstable alluvial terraces underlying urban areas and to expand the use of isotope hydrology techniques in such studies. Specific objectives: to formulate recommendations on the feasibility of engineering options for draining the Valera Terrace, in conjunction with non-Agency supported studies of the terrace's geology and seismology; to assist in the classification of urban areas according to risk for zoning-construction purposes; to contribute to comprehensive multidisciplinary risk evaluation.

BACKGROUND: The terrace on which the city of Valera is located poses problems of instability with massive landslides of the edge of an important sector of the talus. This is an imminent risk to the inhabitants of the city and is the culmination of the combined effect of erosion on the terrace's soil mass, the unfavourable local conditions of steep hillsides and the abundance of clay sediment and recent alluvial deposits, which are very susceptible to erosion by water courses. The terrace consists of an 80-100m thick deposit of easily erodible materials of Quaternary age and is located in a seismically active area in northwestern Venezuela, constituting the sedimentary filling of the valley excavated by the Motatán river. Due to the proximity to the mountainous areas and the high erosion rates during the late Quaternary, the sediments that form the terrace are poorly classified and compacted, resulting in poor mechanical properties against erosion. The tectonic activity in the area lowered the baseline of the Motatán river, which excavated the terrace, developing a vertical cliff that today is more a 70m high. Due to the combined effect of intense rain showers, erosion in the base of the escarpement, seismic activity and the properties of the sediments, the progressive collapse of the terrace has been accelerated recently and, in a medium sized earthquake, most of the terrace could collapse. A comprehensive study of the terrace is needed to determine existing and future risks and to identify actions in the short, medium and long term necessary to control erosion, protect the population and ensure the city's development. The State of Trujillo and the Ministry of the Environment are conducting a multidisciplinary study involving seismology, geology and non-isotope hydrology components, which should be complemented with radioisotope based studies by the Agency. The Agency's counterparts will be the "Pablo Miliani" foundation at the Universidad de Los Andes in Mérida (ULA) as well as its Hydrology and Geology Departments.

PROJECT PLAN: The multidisciplinary study carried out at the national level will be complemented with isotope based studies carried out by the Agency. Since the proper characterization of the origin and dynamics of groundwater in the terrace are extremely important before any decision is taken on the required work to drain the terrace, it is imperative to obtain groundwater samples collected at different depths in the terrace. The samples should be collected from the observation wells drilled during 1998. Stable isotopes of water, together with a few analyses of tritium and carbon-13, should help to identify the recharge area and mechanisms forming groundwater in the terrace. Additionally, natural gamma logging and single-well tracer experiments should provide evidence on the extent to which vertical or horizontal flows control the groundwater movement in the terrace.

NATIONAL COMMITMENT: The central Government and Trujillo State are contributing US \$359,000 in contracts to study the seismological, geological and conventional hydrology aspects relating to the instability of the terrace. The counterpart will also provide equipment and personnel for drilling sample wells and for on-site training, a surveying subcontract, and the actual well drillings and completions. It also undertakes to take all necessary action regarding the safety of the terrace on the basis of the results obtained through the various studies performed; it will, through the Trujillo Technology Institute and the scientific laboratory of ULA, ensure maintenance and repair of all required instrumentation. The total national contribution to this project is estimated at US \$450,000.

AGENCY INPUT: Expert services in sample design and data interpretation and for supervision of drilling and well completion; equipment, including basic instrumentation for drilling observation wells, field monitoring items; isotopic and chemical analysis of selected samples; training in hydrology.

PROJECT IMPACT: After a proper sampling design of wells, a complete hydrological model of the Valera Terrace ; characterization of local and remote recharge, and of leaks in water supply and wastewater systems based on geochemical and isotopic data; models of horizontal and vertical water transport in the terrace and piezometry of the saturated zone; surveys of the horizontal and vertical movement and ground surface; a clear recommendation on steps to be taken to drain the terrace and lower the risk of collapse induced by earthquakes or heavy rains. Local and state authorities are expected to take the necessary remedial action, thus contributing to assuring the safety of more than 100,000 of the city's inhabitants.