

Geological hazard of the Colca Valley - Middle Sector, Arequipa - Peru

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The Colca Valley - Middle Sector is site of advanced developed pre-Inca and Inca cultures, and it was the Incas' natural pathway to Arequipa Valley in southern Peru. The Colca River is the longest waterway in the Pacific Peruvian hydrologic basins. It starts in the Perú Altiplano, crosses the western Andean cordillera and ends in the Pacific Ocean. Surface geologic evidence documents intense, recurrent, and catastrophic geologic surface phenomena (Landslides, debris avalanches, floods, etc.), strong earthquakes, volcanic eruptions, among other phenomena.

The following outstanding active surface geologic phenomena have been studied: Madrigal, Maca, and Lari landslides. The geologic mass movement is towards the present Colca riverbed. The Maca landslide movement accelerated with the Maca (1991), Sepina (1992) and Cabanaconde (1998) strong shallow earthquakes. Another outstanding geologic surface phenomenon is the volcanic-debris avalanche of the northern flank of the Hualca Hualca volcano. This avalanche dammed the Colca River, and gave rise to the Colca Paleolake: ~20 km long, ~3 km wide and ~200 m deep, in the Late Pleistocene.

A geologic hazard assessment procedure has been implemented, which involves: Processing and interpreting satellite images and air photographs, identifying and characterizing surface geologic phenomena evidences, integrating geologic and tectonic information, and verifying them through field work. The procedure allows mapping evidences, categorizing the hazard of the studied and neighboring areas in level of potential danger.

Application of this procedure to study the Colca Valley - Middle Sector allowed defining the geologic-hazard thematic maps that assess the hazard of geologic phenomena that have affected the Colca Valley - Middle Sector through time. These maps will help to implement future risk and disaster risk prevention and mitigation measures.

The geologic hazard map of the Colca Valley - Middle Sector, in a 0 -10 degrees scale, shows the following levels of geologic hazards of the main populated centers: Pinchollo, Maca, Lari and Madrigal have a degree 9 of potential geologic hazard, Tapay: degree 8, Cabanaconde, Canocota and Tuti: degree 7, Achoma, Yanque, Ichupampa and Coporaque: degree 6, and Chivay: degree 5.

The Colca Valley has become a popular tourist-visiting place. The influx of visitors to

this Valley has produced economic, social and cultural recovery of the local Villages, after many centuries of isolation. However, this influx of people could be severely curtailed or may come to a halt because of the high natural hazard of the region due to seismic, volcanic and/or catastrophic surface geological phenomena activities. The vulnerability of the villages and cities to these phenomena is high, the resilience capacity of the community to the impact of a disastrous event is low, hence the disaster risk of the Valley and neighboring area is high. The Colca Valley scenario requires a risk mitigation and a disaster prevention program, to protect the communities, visitors, community's property, and social infrastructure.