

1. INTRODUCTION

Peru, the third largest country in South America bordering on the South Pacific Ocean, is a land of contrast: high mountains, dense jungles, and barren deserts are all found in close proximity. Atico Earthquake occurred off the coast of southern Peru, about 175 km west of Arequipa or about 595 km southeast of Lima at 4:33 PM EDT on Jun 23, 2001 (3:33 PM local time in Peru: See **Figure 1.1**). A revised moment magnitude of 8.4 (Harvard) was computed for this earthquake, making this the largest earthquake to occur anywhere in the world in the past 25 years. The hardest hits by this earthquake included Moquega located on a plateau with an elevation of about 1400m or more. The plateau is for the most part barren though it lies just south of equator, and therefore surface soils are mostly dried up and cemented stiff excluding those found at some oases scattering along some rivers. At some places, local site effects seem to have been responsible for amplifying seismic motions to some considerable extent causing serious destructions of adobe dwellings. One of the most spectacular aspects of this earthquake was damage caused by a tsunami, which surged 1km inland at Camana causing over 2000 structures to be damaged and 2000 hectares of firmland to be flooded.

This report is compiled from observations by the Japan-Peru Joint Reconnaissance Team that followed the June 23, Atico Earthquake, Peru. Before this earthquake, members of IIS (Institute of Industrial Science, University of Tokyo) and CISMID (Japan-Peru Center for Earthquake Engineering and Disaster Mitigation) were organizing an EQTAP* workshop at Lima for a possible collaboration on researches for earthquake disaster mitigation. One of the main goals of this workshop was to discuss a rational methodology for earthquake damage surveys, in which some measured key indexes would provide experts and decision makers with clear criterions for their necessary actions and possible countermeasures. PGA, PGV and SI are useful indexes, to be sure but they are only available where well-maintained instruments are available. In addition they do not always relate physical aspects of an earthquake to necessary actions that we should take. To discuss this issue on the spot, IIS group and CISMID experts decided to perform a joint reconnaissance survey in the affected areas as a pre-workshop arrangement. The team, with a limited number of experts, had little chance to cover up every specialty of civil engineering, seismology, surface geology and tsunami during their short stay there. The team, however, was offered every convenience by the Japan Society of Civil Engineers (JSCE), and adding two experts, Dr. Hiroshi SATO (ERI, University of Tokyo, Surface geology) and Dr. Koshimura (NOAA, Tsunami), the JSCE/EQTAP team was finally organized as listed in the table on the following page.

Though tragic, the death toll of 77 was fairly light considering the magnitude of this earthquake, and the damage seemed to be greatly localized even in a small area. One of the objectives of the team was to inspect this aspect of the earthquake. However, only one strong ground motion record of the main event has been recovered from a station in Moquega. Two other instruments in the epicentral area apparently malfunctioned. The reconnaissance survey of the JSCE/EQTAP team was thus performed in such a way that spatial distributions of the earthquake effects could be clarified. For this, the team members measured microtremors, cracks on utility poles, which can be found everywhere, and analyzed nighttime imageries from satellites.

This report outlines the findings obtained through the reconnaissance survey and some comments by some individuals. All members of the EQTAP/JSCE Reconnaissance Team would like to express hereby their sincere sympathy to those people affected by the Atico earthquake, and they wish to further collaborate with each other for possible countermeasures, e.g., reconstruction of damaged structures and retrofitting of existing structures.

(Kazuo KONAGAI/ Team leader, IIS, University of Tokyo)

* EQTAP: “Earthquake and Tsunami disaster mitigation in the Asia and Pacific region” project, Ministry of Education, Culture, Science and Technology.

ABOUT THE ATICO EARTHQUAKE

Date: June 23, 2001

Time: 3:33 p.m., local time (20:33 GMT).

Magnitude: $M_w=8.4$.

Epicenter: 16.15°S and 73.40°W about 600 km southeast of Lima.

Mainly affected cities: Arequipa, Moquegua, Tacna, Ocoña, Camaná, and Mollendo.

Casualties: 77 deaths, 2,713 injured peoples, and 213,430 affected people.

Damage: 41,394 destroyed or heavily damaged dwellings as well as historical monuments were severely damaged.

Tsunami in Camaná and Chala.

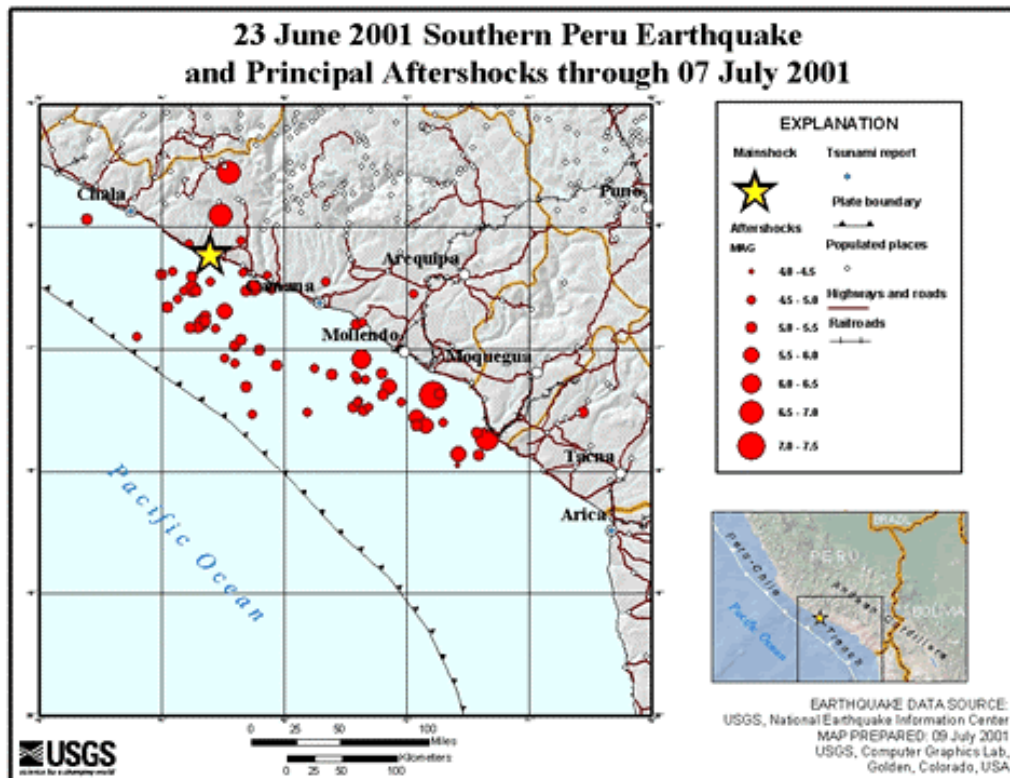


Figure 1.1 Main event and aftershocks (from USGS)

JSCE/EQTAP TEAM MEMBERS

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