

## Learning from Earthquakes

### Bolivian Earthquakes of May 22-23, 1998: A Summary Report

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Ten earthquakes of magnitude 4.2 and above struck the Department of Cochabamba, Bolivia, beginning early (~1:00 a.m.) in the morning of Friday, May 22, 1998. The principal shocks included a Ms = 6.6, a Ms = 5.6, and a mb = 5.3. The larger quakes were felt as far away as the cities of Cochabamba (~50 miles), Sucre (~80 miles), and La Paz, the capital (~200 miles). The map shows the epicenters of all ten earthquakes.

Though moderate events by world standards, the earthquakes caused significant damage and response problems for this remote and poor province and for the Government of Bolivia, the poorest nation in South America on a per capita basis. The indigenous residents in this area have a life expectancy of only 57 years and literacy rates of about 55-58%.

Damage was centered in the Andean highlands towns of Aiquile, Totorá, and Mizque. They are

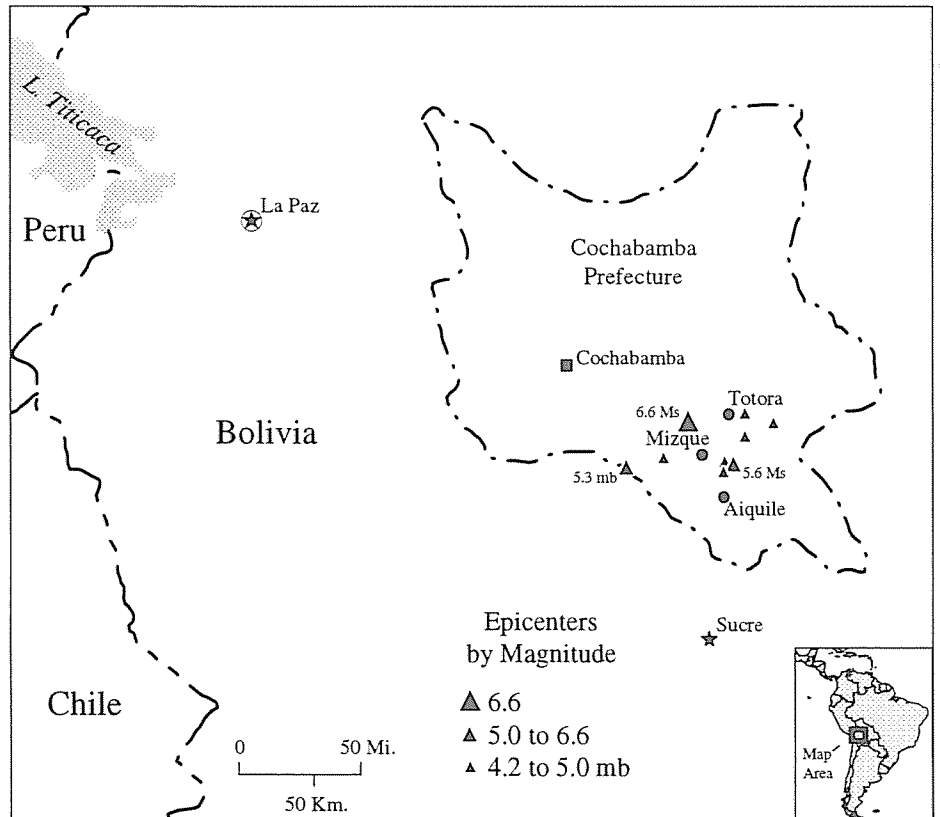


Figure 1 - Epicenters of the ten Bolivian earthquakes.

heavily dependent on agriculture, and are among the poorest in Bolivia. This area has been suffering from other effects of El Niño—drought, crop losses, increasing malnutrition—so the earthquake damage exacerbated an already bad situation.

#### Casualties and Homelessness

Early reports indicated that in the towns of Aiquile and Totorá, at least 16 and maybe as many as 72 people died, and 50-100 people were missing as a result of these earthquakes. It was difficult for field observers to determine the number of injured people because health project staff quickly moved many casualties by road to hospitals in Cochabamba.

Ultimately, 84 fatalities were confirmed. In addition to those caused by structural collapse, other casualties resulted from the suffocating dust that is associated with the fail-

ure of adobe buildings.

Thousands of people lost their dwelling places. Over 500 families were confirmed homeless in Aiquile alone.

#### Structural Damage

Single-story "adobe" (unburnt, sun-dried mud brick) buildings, mostly residences and small shops, greatly dominate this remote region. In fact, there are several relatively large, adobe-style communities in the region that were abandoned when the mining of tin ore ceased several decades ago.

Early reports indicated that 70-80% of the buildings in Totorá and Aiquile were damaged, and about 50% of them (200 buildings) "will have to be torn down." Aftershocks added to the damage and also accelerated the tearing down of damaged structures by relief workers.

In addition, there was substantial



*Figure 2 – A high percentage of the adobe buildings was damaged.*

damage to small “hamlets” in the region which, on the average, number only a few families. For example, 12 hamlets near Totora were not visited until May 24, and casualties in these settlements may have gone unreported, leading to a considerable underestimation of those officially recorded.

### Lifeline Services

Main roads linking Cochabamba, Totora, Mizque and Aiquile remained in serviceable condition, but the earthquakes caused landslides on the road linking Aiquile and Totora. Early situation reports indicated that “Road crews are doing an effective job in keeping the road open.”

The local water system in Aiquile was damaged, and limited service was restored on May 23. However, emergency chlorine treatment was required.

### Early Response Activities

Within Bolivia, 100 soldiers were moved by helicopter to Aiquile to assist with search and rescue operations. Firefighters from Cocha-

bamba also went to the Aiquile area to assist with search and rescue. Bolivia’s national road service leased heavy equipment for search and rescue operations, and the city of Cochabamba provided heavy equipment for search and rescue. Two emergency services vehicles carrying relief supplies— blankets,

mattresses and medicines— left Cochabamba within a few hours of the earthquakes. Potable water and shelter quickly became the most important needs.

U.S. assistance included purchasing local relief supplies (garden hoses, lumber for shelter frames); providing around 4,000 water containers and plastic sheeting sufficient to shelter 800 families; making available air and vehicle transportation; furnishing medical assistance in areas outside the town centers; contributing emergency food to communal kitchens; and supplying cots, blankets, and flashlights. Mexico provided medicines, a mobile hospital, rescue personnel, tents and excavation equipment.

Emergency medical response was aided by the ten-year presence of a Bolivia/United States community and child health project in the stricken area. Sufficient medical personnel were nearby, supplies generally were adequate (except for some antibiotics), and there were radio communications between project officials.



*Figure 3 – Searching an adobe structure after the dust had settled.*