

1. Introduction

Historical Review

According to historical documents dated 1325 A.D., the ancient Aztec city of Tenochtitlan was founded on an islet of Lake Texcoco (1). This lake had an extension of about 1,575 square kilometers (of which 13 square kilometers are still in the Federal District) and was filled with numerous floating islands made up of roots and stems called chinanpas (2). The Mexica used the chinanpas to expand; by filling up channels, making bridges between them, and using drainage and evaporation techniques, they managed to increase their living space and construct the city.

The Aztec empire was destroyed by the conquistadores and among its ruins Hernán Cortés founded the city of Mexico in 1522. Work on the water and drainage system in the valley of Mexico was reinitiated during the colonial period, due to the great floods that occurred in 1606. In January of 1637 an earthquake of great magnitude destroyed the drainage waterworks of the lake. That is the first historical reference to the past seismic activity of the city (3).

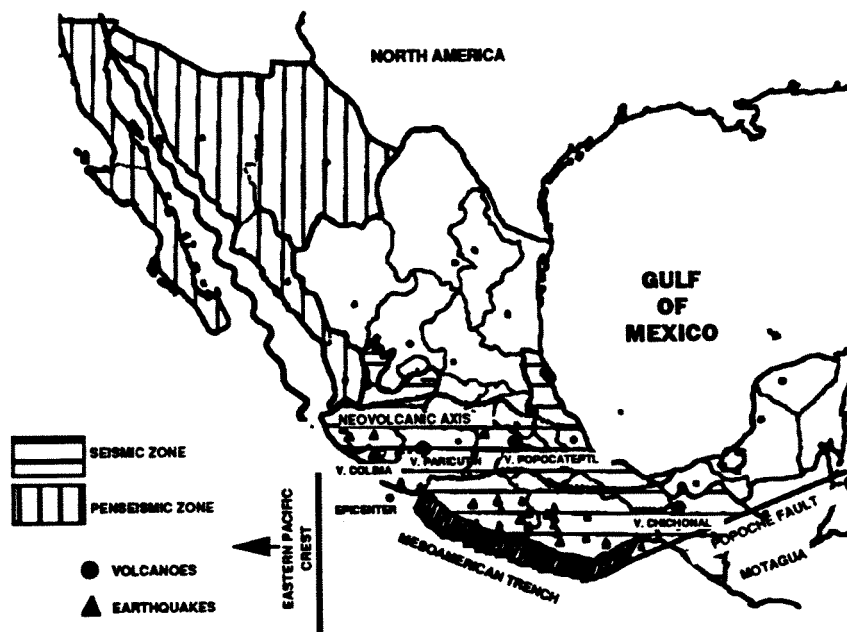
Earthquake Origins

Mexico is a country with major seismic activity. More than 90 earthquakes per year are registered with a magnitude superior to grade 4 on the Richter scale (4). The regions with major seismic risk are the states of Jalisco, Colima, Michoacán, Guerrero, Puebla, Oaxaca and the Federal District. The seismic energy liberated is principally tectonic, produced by the subduction of the Cocos plate on the continental platform of North America (5).

The majority of earthquakes that have occurred in this century, with a magnitude equal to or greater than a 7 on the Richter scale have had their origin on a thin meridional zone between the Sierra Madre on the south and the Pacific coast of the states of Jalisco, Michoacán, Guerrero and Oaxaca (Figure 1).

On September 19, 1985, at 7:19 local time, an intense earthquake with a magnitude of 8.1 on the Richter scale struck the country. The epicenter was located near the coast of the state of Guerrero, about 400 kilometers southeast of Mexico City, at 17.8 degrees north latitude and 102.3 degrees west longitude. The global area affected by the seismic shock waves was estimated at 800,000 square kilometers making this earthquake one of the most powerful of the present century (6). The states most affected were Colima, Guerrero, Oaxaca, Jalisco, Michoacán, Morelos, Veracruz, and the Federal District (Figure 2).

Figure 1: Regional Tectonic Map of Mexico

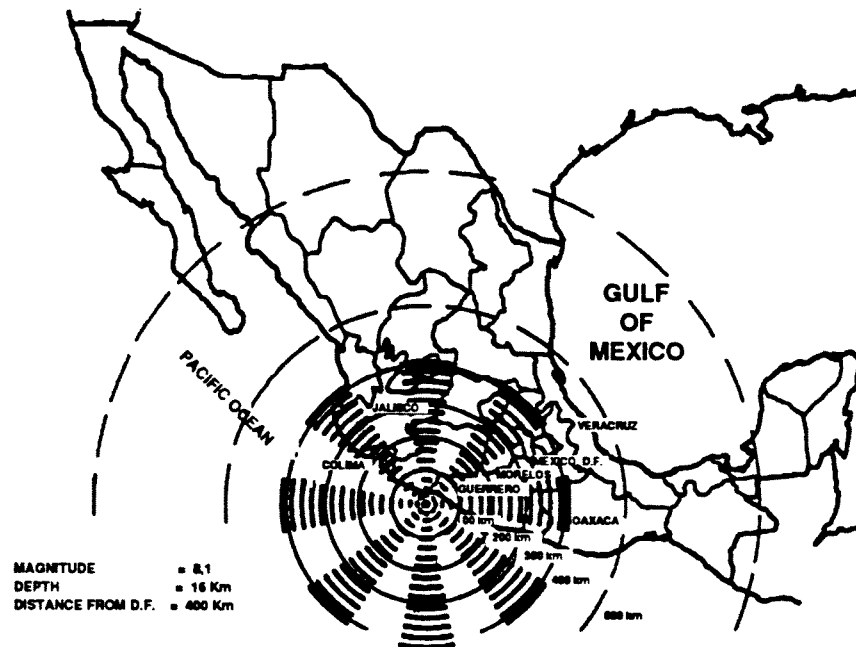


Source: Adapted from Ismael Herrera R., Instituto de Geofísica de la Universidad Nacional Autónoma de México

The following day, at 19:40 p.m. local time, a second seismic movement measuring 7.5 on the Richter scale, with an epicenter at the same place, caused panic in the population despite the fact that the damages were minor when compared to the devastating magnitude of the first (7). During the following 45 days after the earthquakes of September 19 and 20, more than 150 secondary earthquakes were registered, with varying magnitudes between 3.5 and 5 on the Richter scale (8).

The abrupt liberation of seismic energy produced tsunamis of up to 3 meters in height and an advance of 200 meters inland of the ocean coast; numerous cave-ins of roads and rivers; cracks with horizontal and vertical displacements of up to 50 cms; total or partial collapse of many buildings and important damages to the network of public services. The populations most affected were in Ciudad Guzmán, Colima, Tecomán, Playa Azul-Zihuatanejo, Playa Arteaga, Uruapán, Lázaro Cárdenas, Ixtapa Zihuatanejo and Gómez Farias. Without a doubt, the most serious devastation, based on the magnitude and characteristics of damages, took place in the Federal District, particularly in the delegations of Cuauhtemoc and Venustiano Carranza, two of the most densely populated areas of Mexico City (9,10).

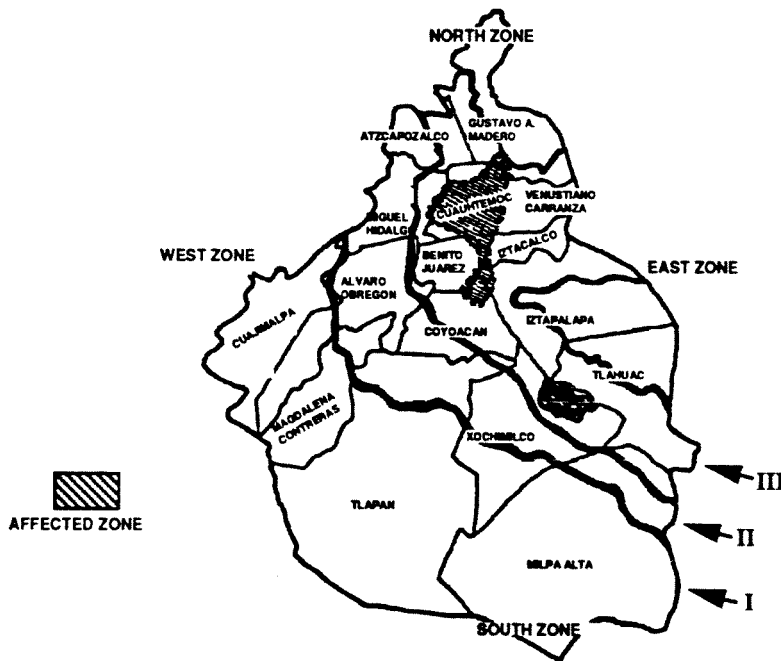
Figure 2. Epicenter and Area Affected by the Seismic Waves



In the central areas of the city the seismic shock waves presented an acceleration four times superior to those registered in peripheral areas (8). The structure of the subsoil in this part of the city, located in an ancient swampland area and made up of deposits of white clay with high compressibility, and the topographic and geological perimeter composition determined a compaction differential of the sediments and liquefaction producing countless waves that were activated by the resonance of the seismic waves trapped in the valley of

Mexico. The greatest damage occurred in the northern part of the Federal District, which is located precisely over the ancient swampland zone where the old Aztec city of Tenochtitlán was located (11 and 12 and Figure 3).

Figure 3. Map of the Federal District Indicates Zone 1, Which is Primarily Mountainous; Zone II, Which Corresponds to the Ancient Swampland and Zone III, Which Corresponds to the Ancient Lake Where the Effects of the Earthquake Were Most Damaging.



Efforts to rescue trapped victims are hampered when buildings are severely damaged. Part of disaster preparedness includes evaluating the vulnerability of construction areas.

