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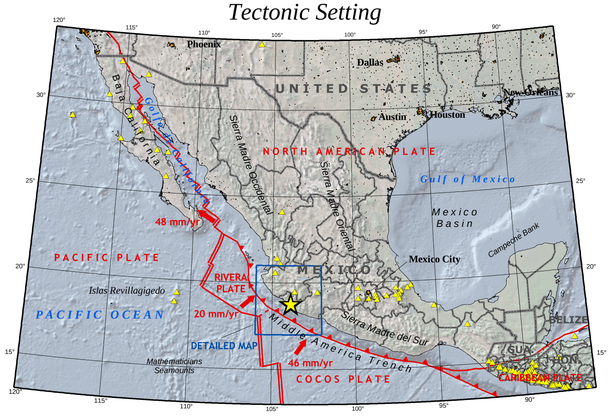
U.S. Department of the Interior
U.S. Geological Survey

General Interest Product xxx

M7.8 Tecomán, Colima, Mexico Earthquake of 22 January 2003

Tectonic Setting



SCALE 1:18,000,000
Lambert Conformal Conic Projection

Kilometers
0 100 200 400 600 800

EXPLANATION

Main Shock

22 January 2003

Plate Boundary

- Convergent
- Diffuse
- Divergent
- Transform

Volcanoes

State Boundary

Urbanized Areas

RELATIVE PLATE MOTIONS

The relative motion of adjacent tectonic plates is depicted on the map by short vectors located at selected locations on the plate boundary. In this presentation, one plate is assumed to be rigid and fixed. The vector therefore represents the direction of the moving plate relative to the fixed plate. The rate of relative motion is labelled next to the vector.

The components of the vector perpendicular and parallel to the plate margin approximate convergent/divergent and transverse direction of motion between the plates, respectively. As viewed from the fixed plate, an inward directed component suggests convergence at and near the plate boundary that may be expressed as crustal folding, uplift, thrust faulting, or plate subduction. Similarly, an outward directed component suggests plate divergence such as would be expected at a zone of crustal spreading. Transcurrent or transform faulting would be expected when the predominant vector component is parallel to the plate margin.

EXPLANATION

Seismic Hazard

- 0 - 0.2 m/sec**2
- 0.2 - 0.4
- 0.4 - 0.8
- 0.8 - 1.6
- 1.6 - 3.2
- 3.2 - 6.4
- 6.4 - 9.8

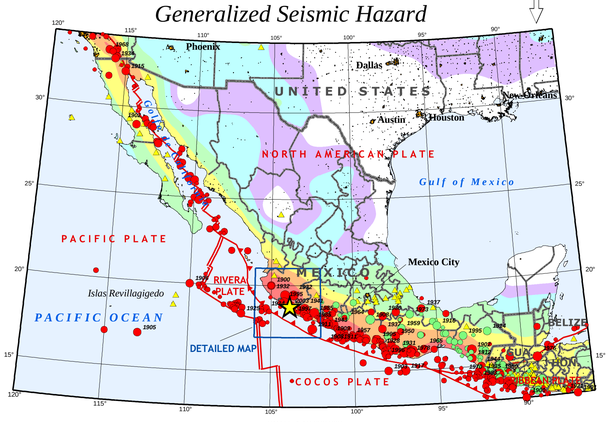
Magnitude Classes

- 5.5 - 5.9
- 6.0 - 6.4
- 6.5 - 6.9
- 7.0 - 7.4
- 7.5 - 8.0

Depth Classes

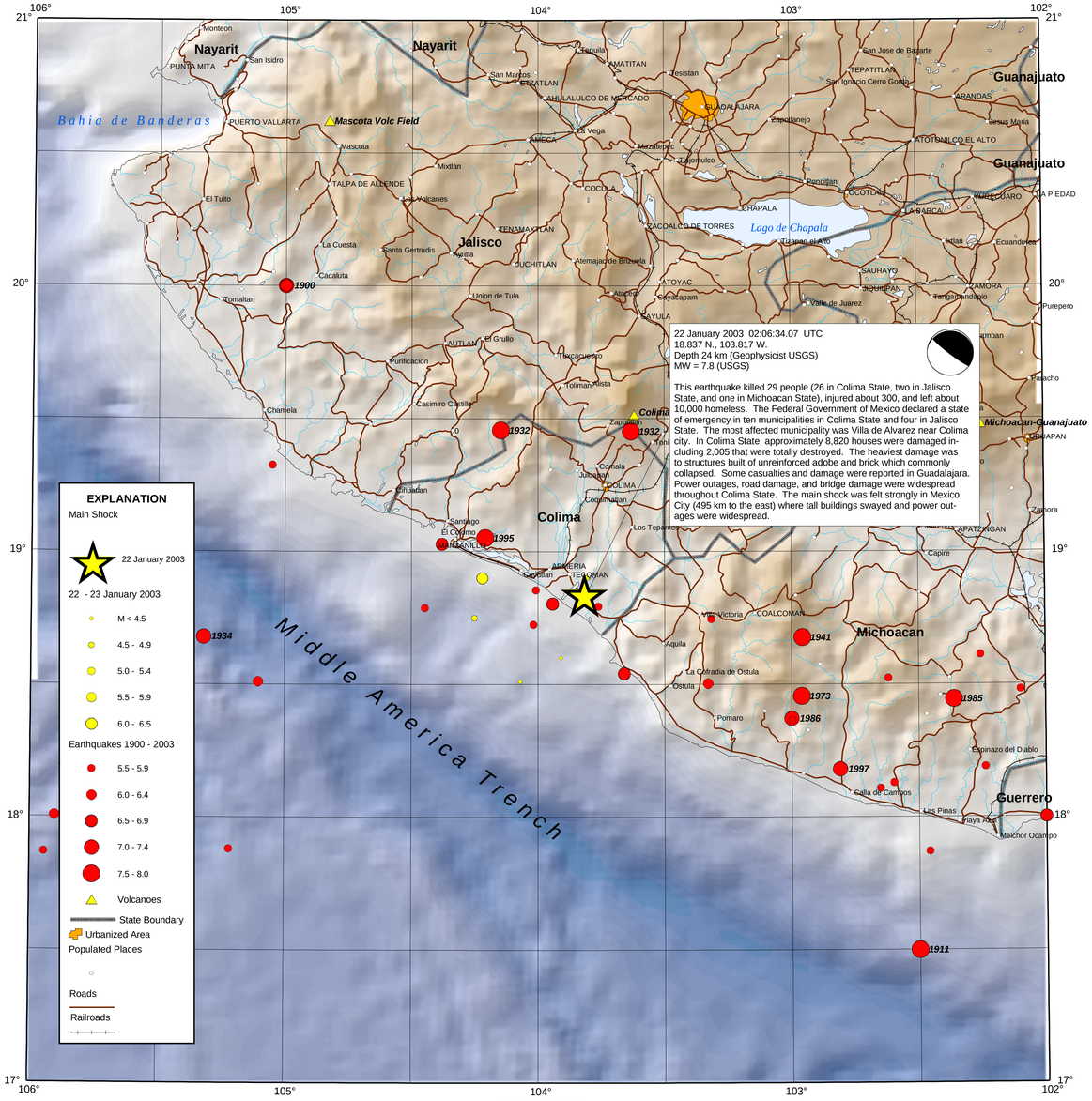
- 0 - 69 km
- 70 - 300 km

Generalized Seismic Hazard



SCALE 1:18,000,000
Lambert Conformal Conic Projection

Kilometers
0 100 200 400 600 800



22 January 2003 02:06:34.07 UTC
18.837 N., 103.817 W.
Depth 24 km (Geophysicist USGS)
MW = 7.8 (USGS)

This earthquake killed 29 people (26 in Colima State, two in Jalisco State, and one in Michoacan State), injured about 300, and left about 10,000 homeless. The Federal Government of Mexico declared a state of emergency in ten municipalities in Colima State and four in Jalisco State. The most affected municipality was Villa de Alvarez near Colima city. In Colima State, approximately 8,820 houses were damaged including 2,005 that were totally destroyed. The heaviest damage was to structures built of unreinforced adobe and brick which commonly collapsed. Some casualties and damage were reported in Guadalajara. Power outages, road damage, and bridge damage were widespread throughout Colima State. The main shock was felt strongly in Mexico City (495 km to the east) where tall buildings swayed and power outages were widespread.

EXPLANATION

Main Shock

22 January 2003

22 - 23 January 2003

- M < 4.5
- 4.5 - 4.9
- 5.0 - 5.4
- 5.5 - 5.9
- 6.0 - 6.5

Earthquakes 1900 - 2003

- 5.5 - 5.9
- 6.0 - 6.4
- 6.5 - 6.9
- 7.0 - 7.4
- 7.5 - 8.0

Volcanoes

State Boundary

Urbanized Area

Populated Places

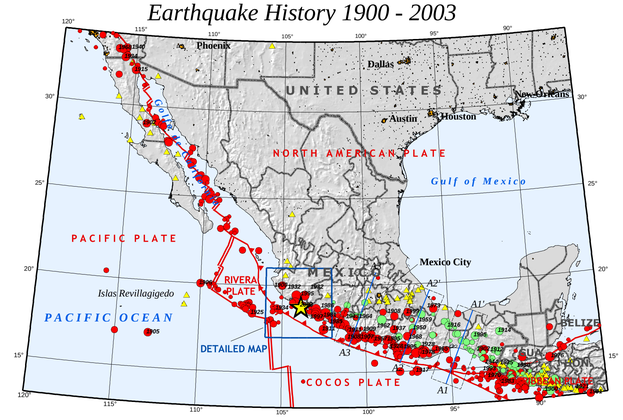
Roads

Railroads

SCALE 1:1,100,000
Albers Equal-Area Projection

Kilometers
0 10 20 40 60 80

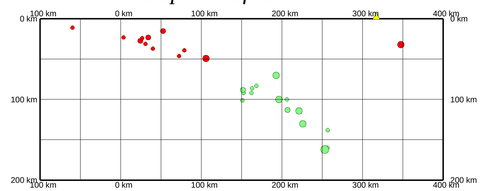
Earthquake History 1900 - 2003



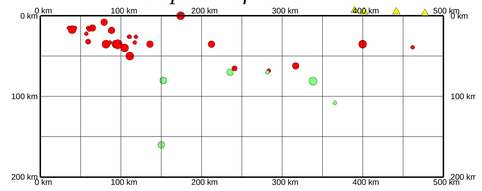
SCALE 1:18,000,000
Lambert Conformal Conic Projection

Kilometers
0 100 200 400 600 800

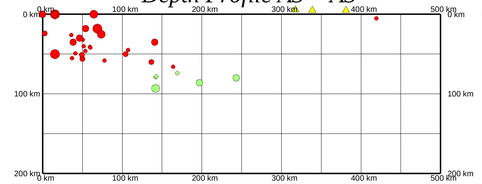
Depth Profile A1 - A1'



Depth Profile A2 - A2'



Depth Profile A3 - A3'



EXPLANATION

Main Shock

22 January 2003

Magnitude Classes

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Volcanoes

State Boundary

Urbanized Areas

LARGEST EARTHQUAKES 1900 - 2003 M GE 7.5
MEXICO AND VICINITY

YR	MO	DY	LAT	LON	DEPTH	MAG
1902	4	19	14.000	-91.000	0	7.50
1902	9	23	16.000	-93.000	0	7.80
1907	4	15	17.000	-100.000	0	7.90
1908	3	26	18.000	-99.000	80	7.70
1909	7	30	17.000	-100.500	0	7.60
1911	6	7	17.500	-102.500	0	7.60
1911	12	16	17.000	-100.500	50	7.60
1917	12	29	15.000	-97.000	0	7.50
1928	3	22	16.127	-96.505	35	7.50
1928	6	17	16.028	-97.036	35	7.70
1928	10	9	16.229	-97.556	35	7.50
1931	1	15	16.053	-96.614	35	7.90
1932	6	3	19.457	-104.146	25	7.90
1932	6	18	19.452	-103.632	54	7.90
1941	4	15	18.677	-102.957	35	7.60
1942	8	6	13.780	-90.913	35	7.70
1950	10	23	14.500	-91.500	0	7.50
1957	7	28	16.881	-99.297	37	7.80
1973	1	30	18.455	-102.969	37	7.60
1976	2	4	15.297	-89.145	12	7.50
1978	11	29	16.012	-96.602	25	7.80
1979	3	14	17.759	-101.222	25	7.50
1985	9	19	18.444	-102.361	22	8.00
1985	9	21	17.827	-101.622	18	7.60
1995	10	9	19.052	-104.208	26	8.00
1999	9	30	16.055	-96.905	40	7.50
2003	1	22	18.837	-103.817	24	7.80

Seismic hazard is expressed as peak ground acceleration (PGA) on rock or firm soil, in meters/sec**2, expected in a 50-yr period with a probability of 10 percent.

DISCUSSION

This shallow earthquake occurred in a seismically active zone near the coast of central Mexico. The earthquake occurred near the junction of three tectonic plates: the North American Plate to the north-west, the Rivera Plate to the north-east, and the Cocos Plate to the south. Both the Rivera Plate and the Cocos Plate are being consumed beneath the North American Plate in a north-west direction. The slower moving Rivera Plate is moving north-west at about 2 cm per year relative to the North American Plate and the faster moving Cocos plate is moving in a similar direction at a rate of about 4.5 cm per year.

There have been several significant earthquakes near the recent event. In 1932 a magnitude 8.4 thrust earthquake struck about 100 km to the north-west. More recently, on October 9th 1995, a large earthquake struck about 20 km to the north-west. This magnitude 8.0 shock on Oct 9th killed at least 49 people and left 1,000 homeless. The most deadly earthquake in the region occurred about 170 km to the south-east on September 19,1985. This magnitude 8.0 earthquake killed at least 9,500 people, injured about 30,000, and left 100,000 people homeless.

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
UN Office for the Coordination of Humanitarian Affairs
IASPEI, Centennial Catalog (1900 - 1999)
Handbook of Seismology and Earthquake Engineering
Global Seismic Hazard Assessment Program

PLATE TECTONICS
Smithsonian Institution, Global Volcano Program

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center

Map prepared by U.S. Geological Survey
National Earthquake Information Center
4 February 2003
Map not approved for release by Director USGS