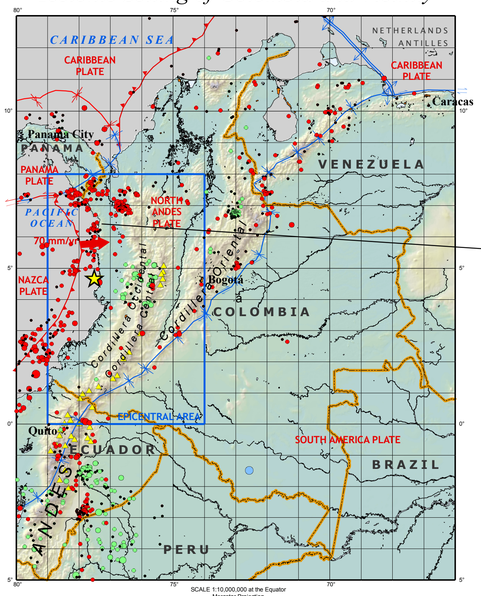
M7.2 Colombia Earthquake of 15 November 2004

Tectonic Setting of Colombia and Vicinity



RELATIVE PLATE MOTIONS

The relative motion of adjacent tectonic plates is depicted on the map by short vectors located at selected points on the plate boundary. In this presentation, one plate (the reference plate) is assumed to be fixed. The vector therefore represents the direction of the moving plate relative to the reference 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.

In western South America, the Nazca plate is moving generally eastward relative to the fixed South America plate. The Peru-Chile Trench and the Andes are the result of subduction of the Nazca Plate. In western Colombia, the motion of the Nazca plate relative to the South American plate is about 70 mm/yr.

EXPLANATION

Main Shock
- *15 November 2004*

Depth Classes
- 0 - 69 km
- 70 - 299
- 300 - 700

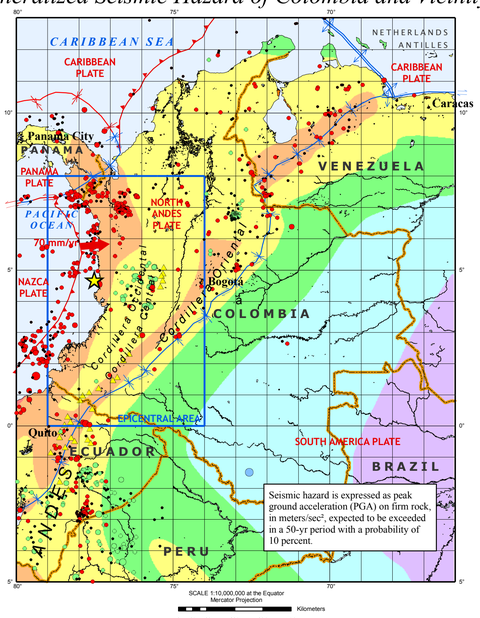
Magnitude Class
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- 8.0 - 8.9

Plate Boundary
- Continental Convergent
- Continental Rift
- Continental LL Transform
- Continental RL Transform
- Oceanic Convergent
- Oceanic LL Transform
- Subduction

Volcano

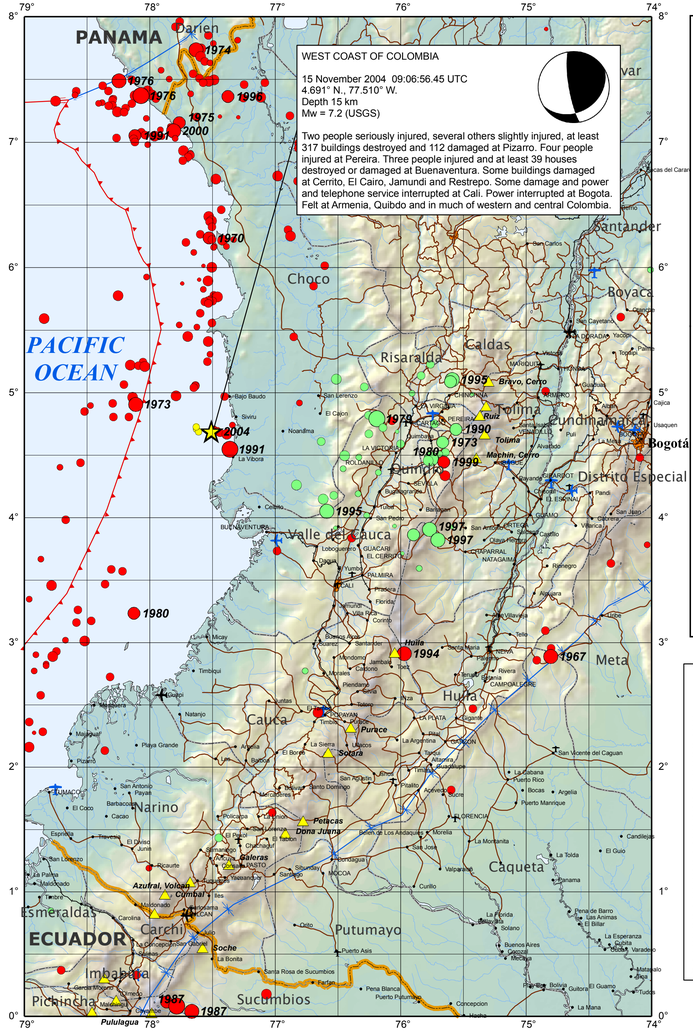
Seismic Hazard
- 0.2 - 0.4 m/sec²
- 0.4 - 0.8
- 0.8 - 1.6
- 1.6 - 3.2
- 3.2 - 6.4
- 6.4 - 9.8

Generalized Seismic Hazard of Colombia and Vicinity



Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

Epicentral Area



EXPLANATION

Main Shock
- *15 November 2004*

Aftershocks
- *15 - 24 November 2004*

Depth Classes
- 0 - 69 km
- 70 - 299

Magnitude Classes
- 4.0 - 4.4
- 4.5 - 4.9
- 5.0 - 5.4
- 5.5 - 5.9
- 6.0 - 6.4
- 6.5 - 6.9
- 7.0 - 7.4

Plate Boundary
- Continental Convergent
- Continental RL Transform
- Oceanic LL Transform
- Subduction

Volcano
- *Tolima*

Urbanized Area

Populated Place
- *Cerrito*

Highways and Roads

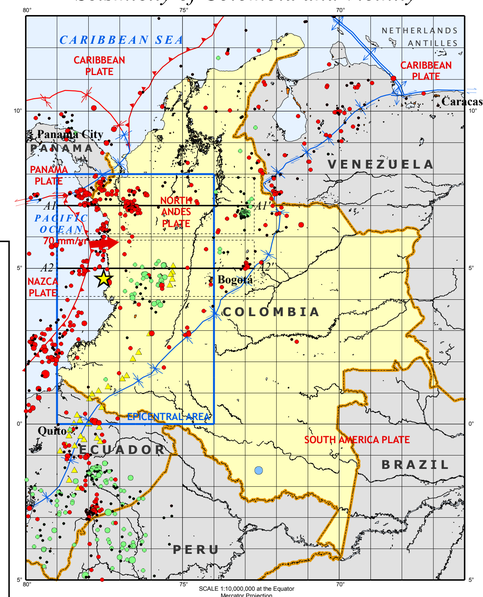
Railroad

Airport
- Active Civil and Military
- Active Civil
- Active Military
- Other

LARGEST EARTHQUAKES 1964 - 2002
EPICENTRAL AREA

YR	MO	DY	LAT	LON	DEPTH	MAG
1967	2	9	2.888	-74.803	40.7	6.4
1970	9	26	6.237	-77.528	11.8	6.0
1973	4	3	4.604	-75.668	151.2	6.1
1973	4	24	4.907	-78.113	25.2	6.4
1974	7	13	7.736	-77.632	4.9	6.4
1975	1	25	7.154	-77.766	35.2	6.0
1976	7	11	7.489	-78.246	5.6	6.8
1976	7	11	7.372	-78.071	17.9	7.3
1977	8	31	7.352	-76.159	20.8	6.6
1979	11	23	4.793	-76.190	108.4	7.2
1980	6	25	4.471	-75.756	165.3	6.4
1980	9	3	3.235	-78.127	30.7	6.1
1987	3	6	0.115	-77.868	5.8	6.0
1987	3	6	0.083	-77.786	16.7	7.2
1987	3	6	0.041	-77.666	12.3	6.4
1990	11	23	4.706	-75.560	142.9	6.0
1991	4	4	7.052	-78.120	33.0	6.2
1991	11	19	4.549	-77.361	21.0	7.2
1992	10	17	6.869	-76.726	14.0	6.8
1992	10	18	7.093	-76.764	3.3	7.3
1994	6	6	2.912	-75.971	12.0	6.8
1994	9	13	7.100	-76.659	14.0	6.1
1995	2	8	4.052	-76.589	74.0	6.4
1995	8	19	5.106	-75.589	120.0	6.6
1996	11	4	7.364	-77.379	14.0	6.3
1997	9	2	3.823	-75.703	206.0	6.8
1997	12	11	3.907	-75.769	178.0	6.4
1999	1	25	4.445	-75.657	17.0	6.2
2000	11	8	7.091	-77.811	17.0	6.5

Seismicity of Colombia and Vicinity



EXPLANATION

Main Shock
- *15 November 2004*

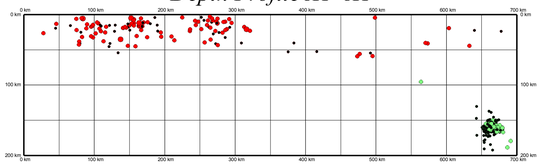
Depth Classes
- 0 - 69 km
- 70 - 299
- 300 - 700

Magnitude Class
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- 8.0 - 8.9

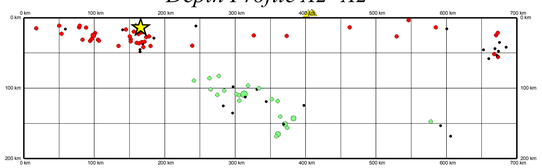
Plate Boundary
- Continental Convergent
- Continental Rift
- Continental LL Transform
- Continental RL Transform
- Oceanic Convergent
- Oceanic LL Transform
- Subduction

Volcano

Depth Profile A1- A1'



Depth Profile A2- A2'



DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
HDF (unpublished earthquake catalog) (Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS
PB2003 (Bird, 2003)

VOLCANOES
Smithsonian Institution, Global Volcano Program

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

NEWS SOURCES
Associated Press

DISCUSSION

The earthquake occurred near the boundary of the Nazca and South American plates. In this region, the Nazca plate is moving easterly with respect to the South American plate with a velocity of about 70 mm/year and subducting beneath it. The location and focal mechanism of the earthquake are consistent with the shock's occurring on the thrust interface between the plates. The Mw = 7.2 earthquake of November 11, 1991 had a very similar location and focal-mechanism; the 1991 shock killed two people.

REFERENCES

Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027- 80.

Engdahl, E.R. and Villaseñor, A., 2002, Global Seismicity: 1900 - 1999, chap. 41 of Lee, W.H.K., and others,eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academeic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination: Bull. Seism. Soc. Amer., v. 88, p. 722-743.

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.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
30 November 2004
Map not approved for release by Director USGS