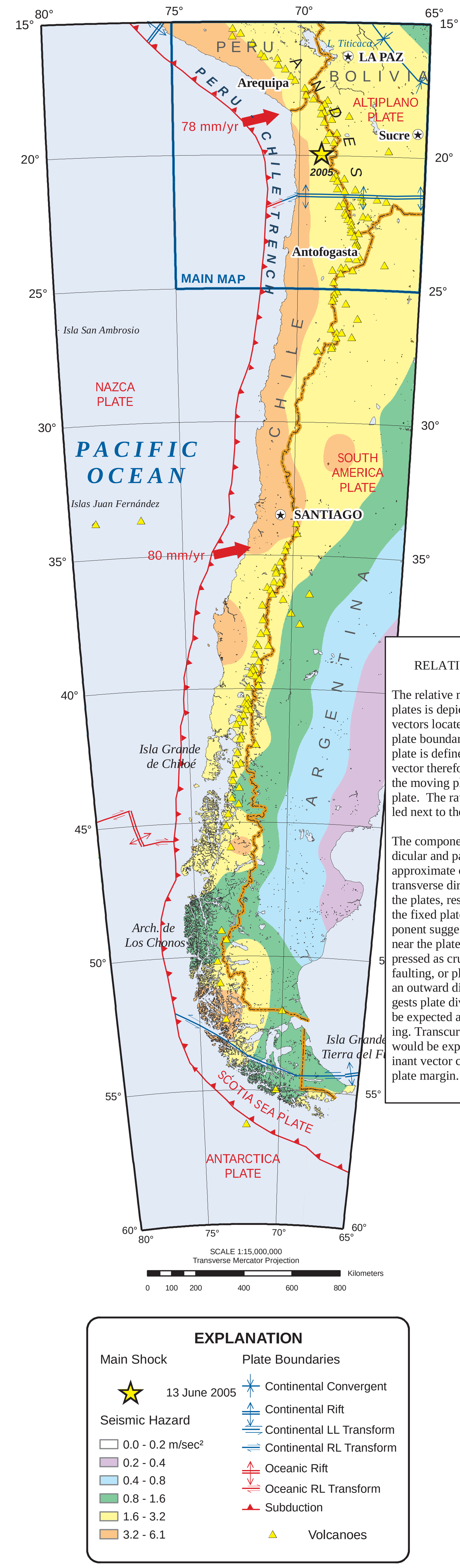
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

M7.8 Northern Chile Earthquake of 13 June 2005

Generalized Seismic Hazard



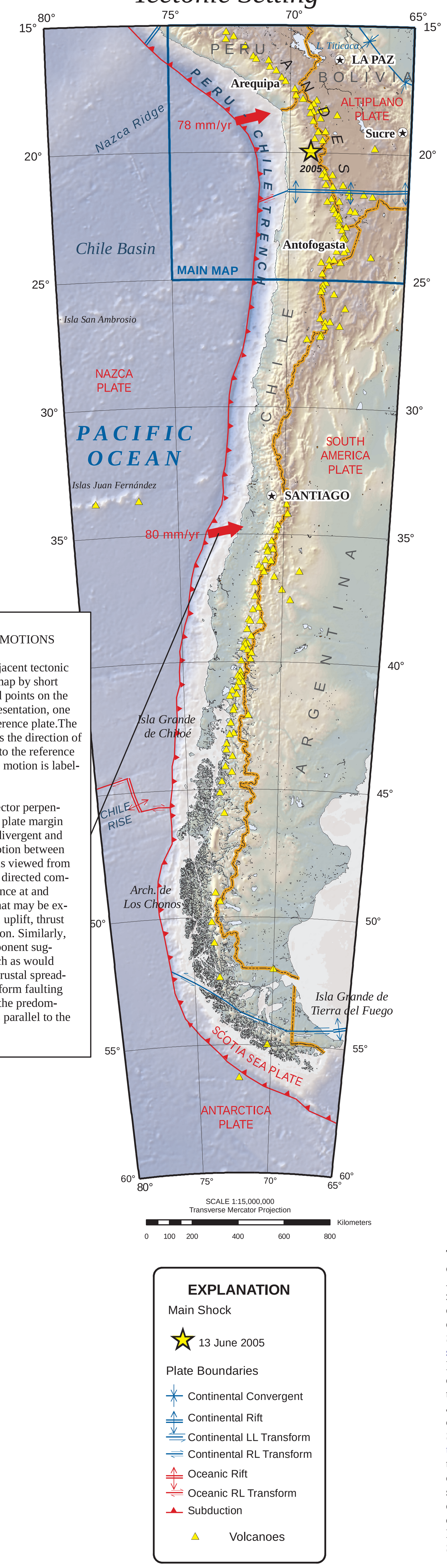
Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

RELATIVE PLATE MOTIONS

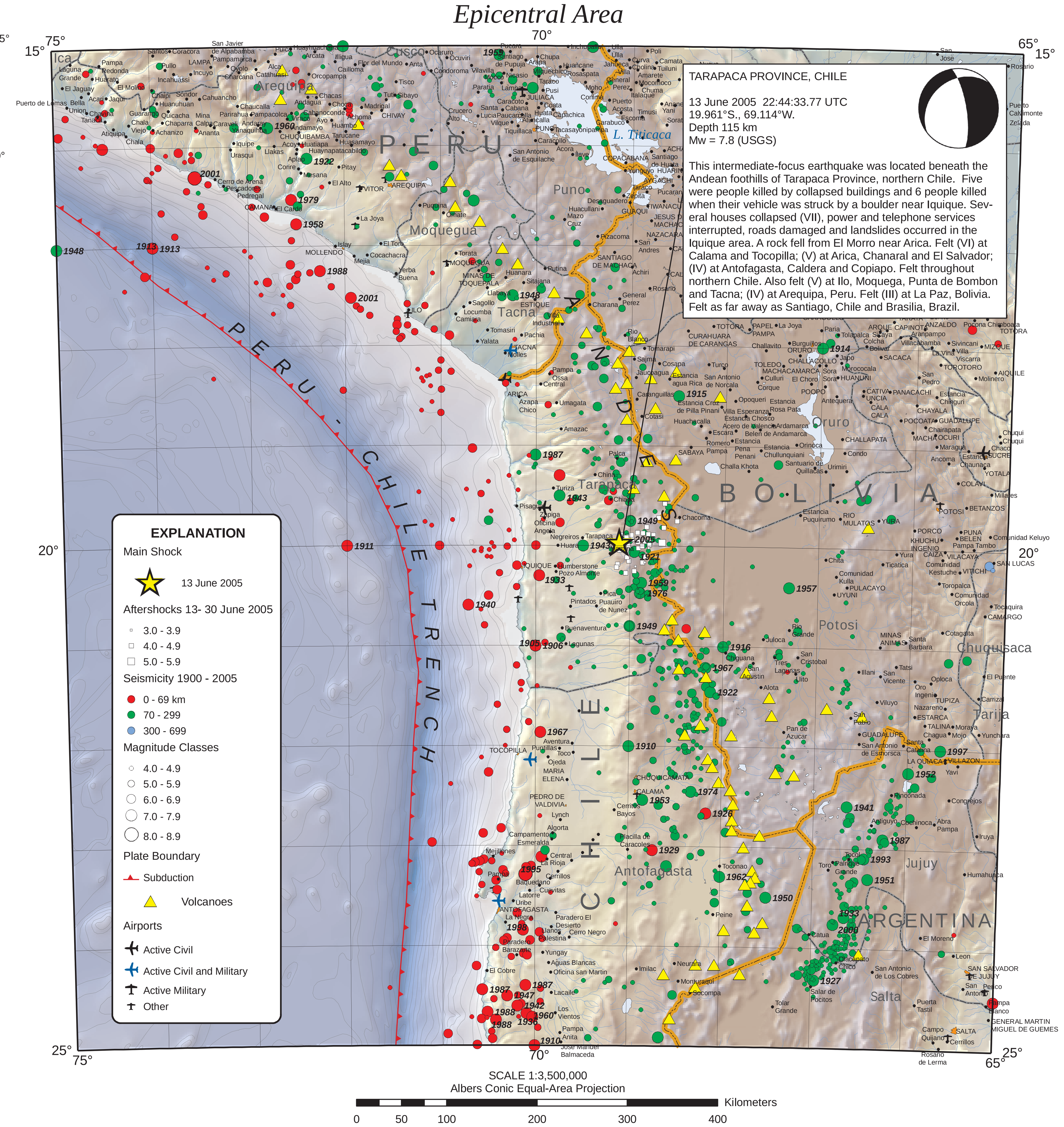
The relative motion of adjacent tectonic plates is depicted on the map by short vectors located at selected points on the plate boundary. In this presentation, one plate is defined as the reference plate.The vector therefore represents the direction of the moving plate relative to the reference plate.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

Tectonic Setting



Epicentral Area

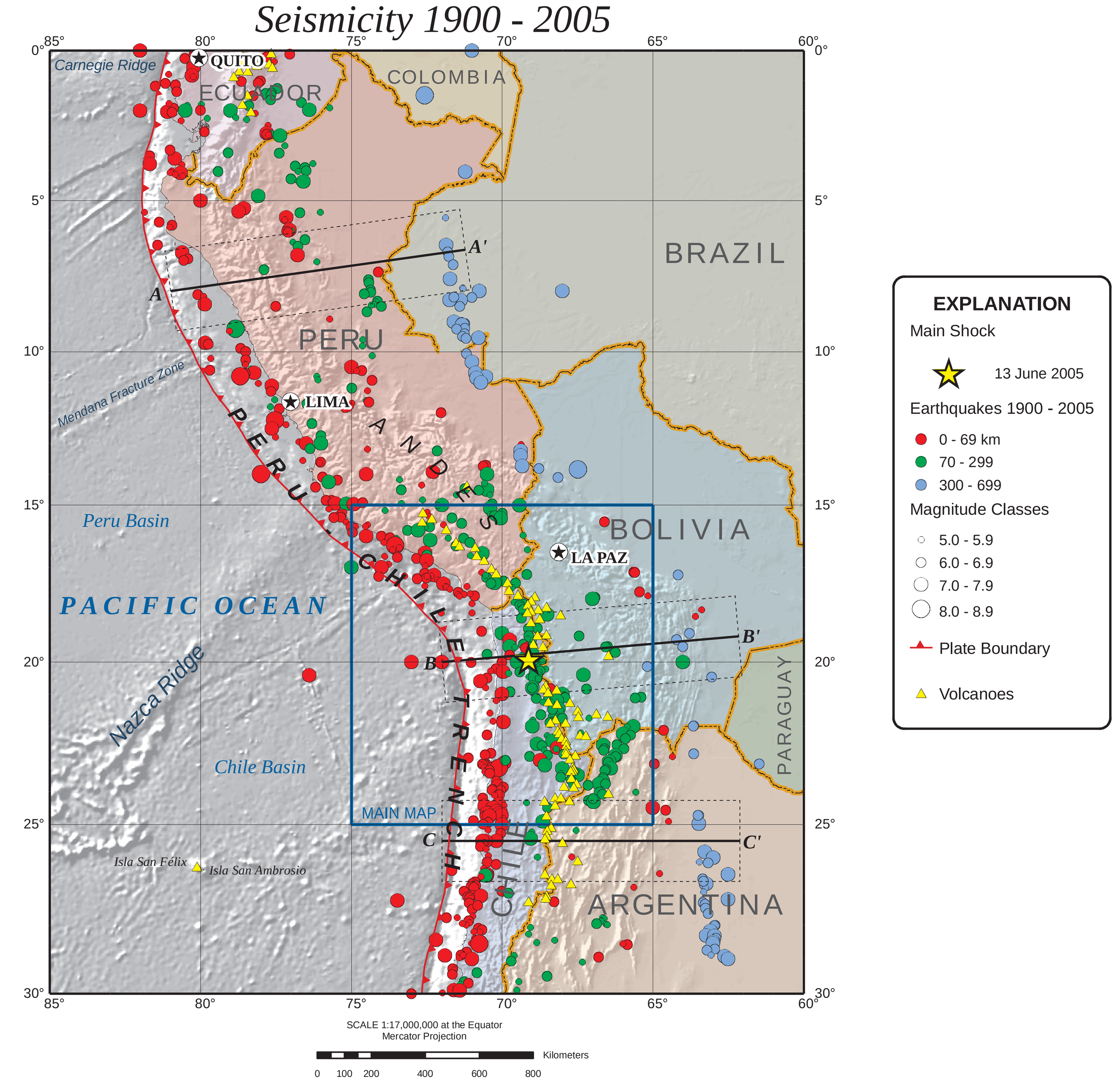


TARAPACA PROVINCE, CHILE

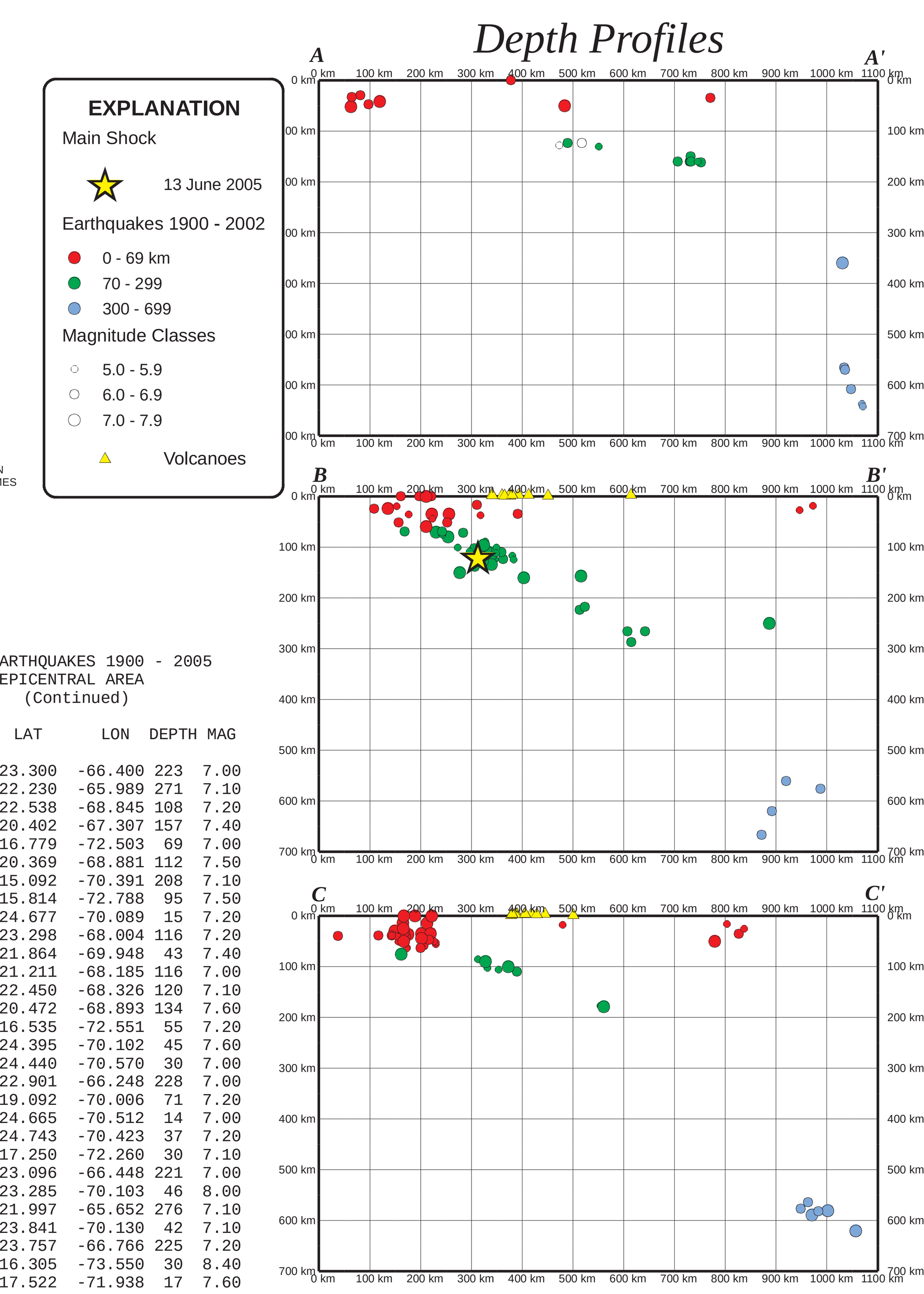
13 June 2005 22:44:33.77 UTC
19.961°S., 69.114°W.
Depth 115 km
Mw = 7.8 (USGS)

This intermediate-focus earthquake was located beneath the Andean foothills of Tarapaca Province, northern Chile. Five were people killed by collapsed buildings and 6 people killed when their vehicle was struck by a boulder near Iquique. Several houses collapsed (VII), power and telephone services interrupted, roads damaged and landslides occurred in the Iquique area. A rock fell from El Morro near Arica. Felt (VI) at Calama and Tocopilla; (V) at Arica, Chanaral and El Salvador; (IV) at Antofagasta, Caldera and Copiapo. Felt throughout northern Chile. Also felt (V) at Ilo, Moquega, Punta de Bombon and Tacna; (IV) at Arequipa, Peru. Felt (III) at La Paz, Bolivia. Felt as far away as Santiago, Chile and Brasilia, Brazil.

Seismicity 1900 - 2005



Depth Profiles



DISCUSSION

This earthquake resulted from the release of stresses that were generated by the subduction of the oceanic Nazca plate beneath the South American plate. In this region, known as the Peru-Chile subduction zone, ongoing subduction occurs at a rate of about 7.8 cm/year in an east-north-east direction. The subduction process generates numerous earthquakes and volcanism, and actively builds the Andes mountains. Subduction zones [http://earthquake.usgs.gov/image_glossary/subduction.html] produce the biggest earthquakes on the planet. The largest earthquake of the past 100 years, the magnitude 9.5 1960 Chilean earthquake [/neis/eq_depot/world/1960_05_22.html], occurred in the Peru-Chile subduction zone. The 1960 Chilean earthquake ruptured a 900-km long swath along the Chilean coast about 2000 km to south of the 13 June 2005 earthquake. The devastating 26 December 2004 Sumatra-Andaman Island's earthquake and tsunami [http://earthquake.usgs.gov/eqinthenews/2004/usslav/] occurred in a subduction zone in the Indian Ocean. Those and others of the very largest subduction zone earthquakes were thrust-fault earthquakes on the interface between the subducting plate and the overriding plate, and much of their seismic energy was the result of faulting at depths of 50 km and less . The earthquake of 13 June 2005, by contrast, occurred within the subducted Nazca plate rather than at the interface between the Nazca plate and the South American plate, and it occurred at a depth of about 120 km.

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.

LARGEST EARTHQUAKES 1900 - 2005 EPICENTRAL AREA

YR	MO	DY	LAT	LON	DEPTH	MAG
1905	4	26	-21.000	-70.000	60	7.00
1906	8	30	-21.000	-70.000	0	7.10
1906	12	26	-20.000	-73.000	0	7.00
1910	9	6	-25.000	-70.000	0	7.10
1910	10	4	-22.000	-69.000	120	7.20
1911	9	15	-20.000	-72.000	0	7.10
1913	7	28	-17.000	-74.000	0	7.00
1913	8	6	-17.000	-74.000	0	7.80
1914	2	26	-18.000	-67.000	130	7.20
1915	6	6	-18.500	-68.500	160	7.30
1916	8	25	-21.000	-68.000	180	7.00
1921	10	20	-20.060	-68.956	114	7.20
1922	3	28	-21.454	-68.130	136	7.10
1922	10	11	-16.125	-72.385	160	7.60
1926	4	28	-22.665	-68.164	35	7.10
1927	11	26	-24.320	-66.963	179	7.00
1929	10	19	-23.038	-68.737	35	7.40
1933	2	23	-20.297	-69.965	35	7.20
1933	10	25	-23.686	-66.650	207	7.00
1936	7	13	-24.715	-70.023	35	7.10
1940	10	4	-20.592	-70.718	24	7.10
1941	4	3	-22.579	-66.642	150	7.20
1942	7	8	-24.602	-70.189	35	7.00
1943	3	14	-20.000	-69.500	150	7.10
1943	12	1	-19.500	-69.750	80	7.10
1947	1	21	-24.500	-70.300	0	7.00
1948	5	11	-17.500	-70.250	70	7.40
1948	7	20	-17.000	-75.000	70	7.10
1949	4	25	-19.750	-69.000	110	7.20
1949	5	30	-20.800	-69.000	96	7.00
1950	12	9	-23.500	-67.500	100	7.70

LARGEST EARTHQUAKES 1900 - 2005 EPICENTRAL AREA (Continued)

YR	MO	DY	LAT	LON	DEPTH	MAG
1951	4	14	-23.300	-66.400	223	7.00
1952	9	21	-22.230	-65.989	271	7.10
1953	12	7	-22.538	-68.845	108	7.20
1957	11	29	-20.402	-67.307	157	7.40
1958	1	15	-16.779	-72.503	69	7.00
1959	6	14	-20.369	-68.881	112	7.50
1959	7	19	-15.092	-70.391	208	7.10
1960	1	13	-15.814	-72.788	95	7.50
1960	12	2	-24.677	-70.089	15	7.20
1962	8	3	-23.298	-68.004	116	7.20
1967	12	21	-21.864	-69.948	43	7.40
1967	12	27	-21.211	-68.185	116	7.00
1974	1	2	-22.450	-68.326	120	7.10
1976	11	30	-20.472	-68.893	134	7.60
1979	2	16	-16.535	-72.551	55	7.20
1987	3	5	-24.395	-70.102	45	7.60
1987	3	5	-24.440	-70.570	30	7.00
1987	4	1	-22.901	-66.248	228	7.00
1987	8	8	-19.092	-70.006	71	7.20
1988	1	19	-24.665	-70.512	14	7.00
1988	2	5	-24.743	-70.423	37	7.20
1988	4	12	-17.250	-72.260	30	7.10
1993	5	24	-23.096	-66.448	221	7.00
1995	7	30	-23.285	-70.103	46	8.00
1997	1	23	-21.997	-65.652	276	7.10
1998	1	30	-23.841	-70.130	42	7.10
2000	5	12	-23.757	-66.766	225	7.20
2001	6	23	-16.305	-73.550	30	8.40
2001	7	7	-17.522	-71.938	17	7.60
2005	6	13	-19.961	-69.114	115	7.80

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
GLOBE (1999)
IOC, IHO, and BODC (2003)
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center

NEWS SOURCES
ABC News Online
Guardian Unlimited

REFERENCES

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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 Academic 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.

GLOBE Task Team and others, 1999, The Global Land One-Kilometer Base Elevation (GLOBE) Digital Elevation Model, Version 1.0: National Oceanic and Atmospheric Administration, Boulder, Colo., USA.

IOC, IHO, and BODC, 2003, Centenary Edition of the GEBCO Digital Atlas: CD-ROM(2), British Oceanographic Data Centre, Liverpool, UK.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
7 July 2005
Map not approved for release by Director USGS