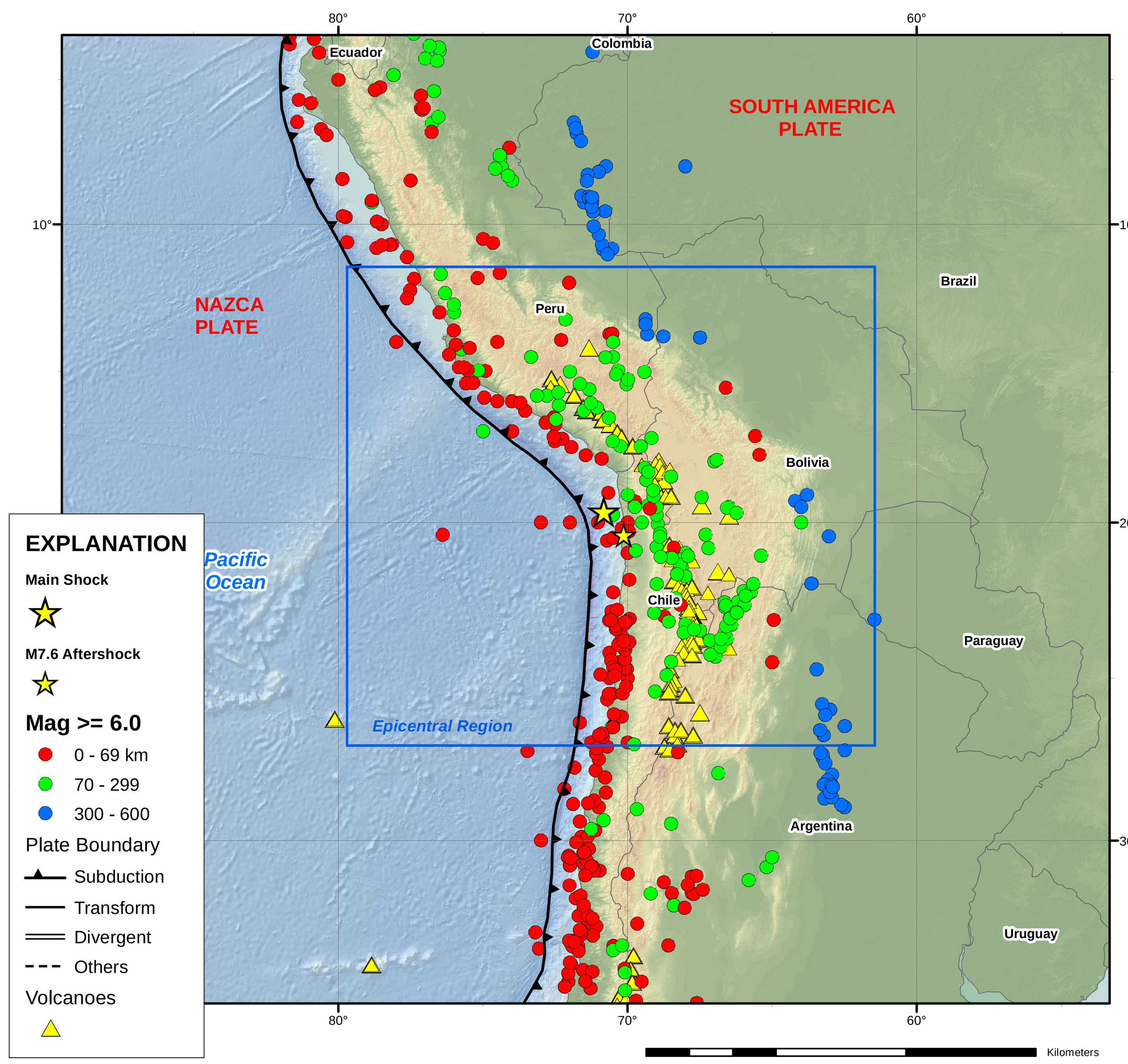
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

EARTHQUAKE SUMMARY MAP

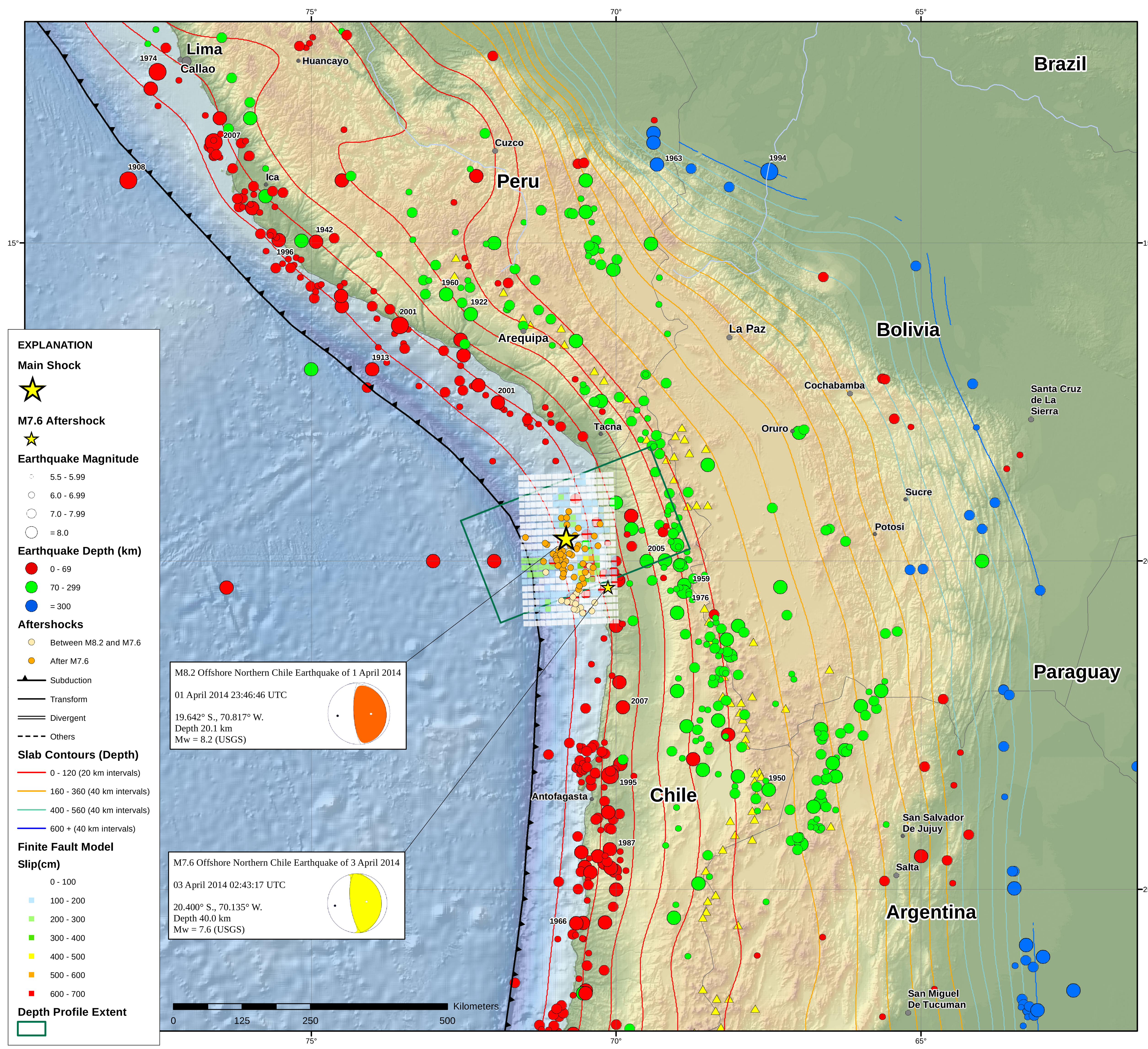
Prepared in cooperation with the Global Seismographic Network

M8.2 and Aftershocks Offshore Northern Chile Earthquake of 1 April 2014

Tectonic Setting



Epicentral Region



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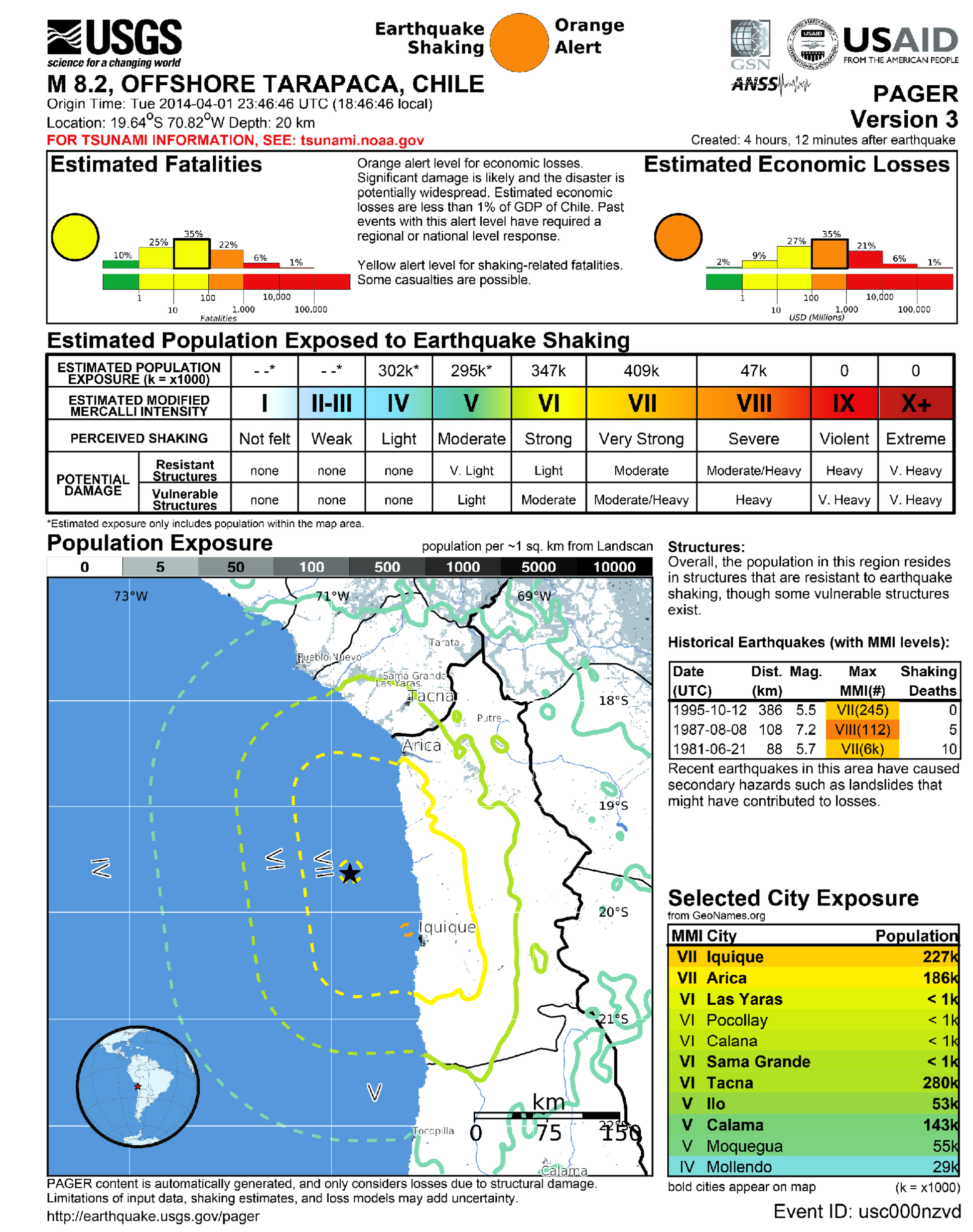
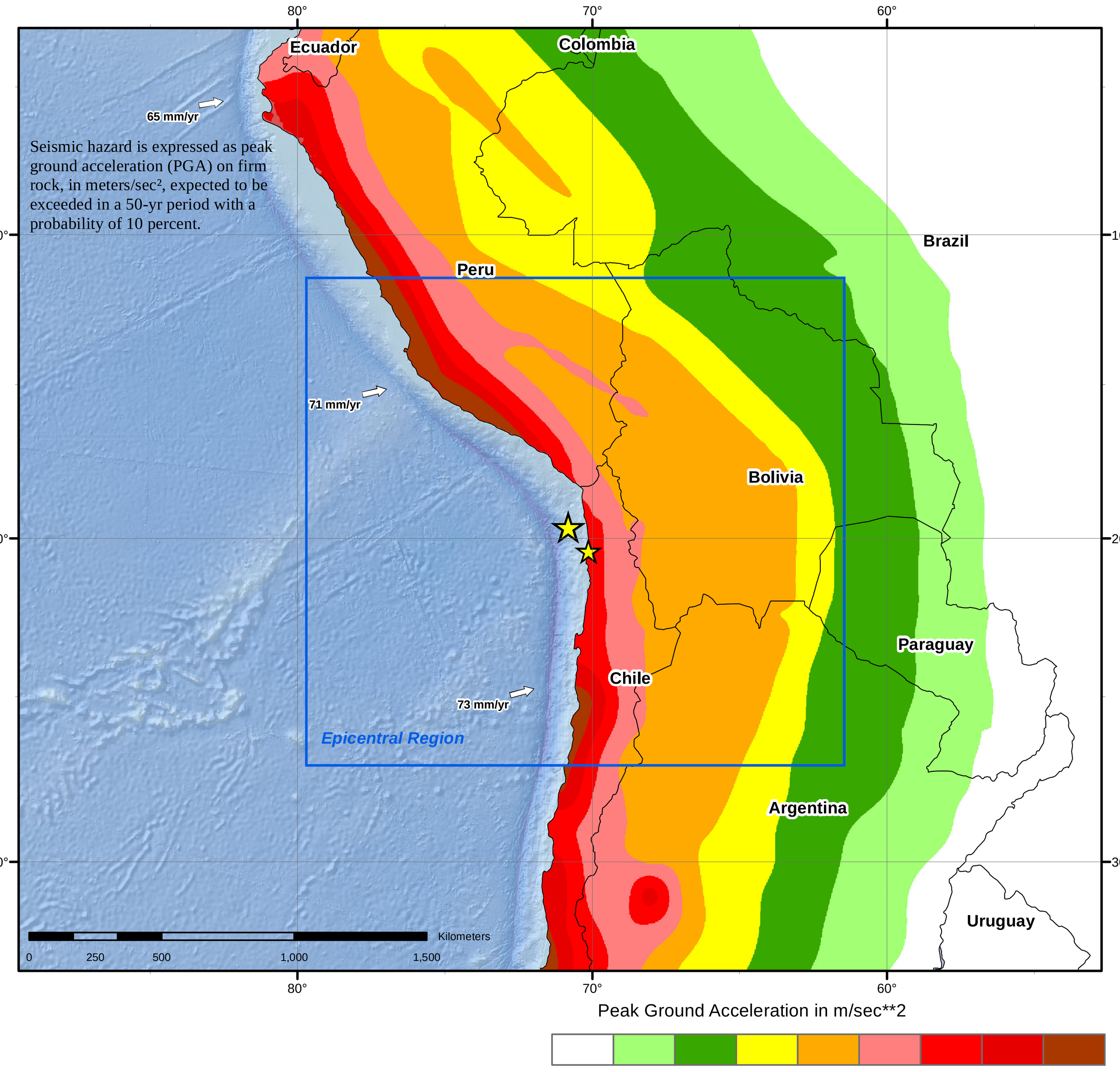


Seismic Hazard



Significant Earthquakes Mag >= 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1908	12	12	1208	-14.000	-78.000	60	8.2
1913	08	06	2214	-17.000	-74.000	0	7.8
1922	10	11	1450	-16.125	-72.385	160	7.6
1942	08	24	2250	-14.975	-74.920	35	7.7
1950	12	09	2138	-23.500	-67.500	100	7.7
1959	06	14	0012	-20.369	-68.881	111	7.5
1960	01	13	1540	-15.814	-72.788	95.4	7.5
1963	08	15	1725	-13.742	-69.332	552	7.7
1966	12	28	0818	-25.502	-70.655	30	7.7
1974	10	03	1421	-12.254	-77.524	33.9	8.1
1976	11	30	0041	-20.472	-68.893	133	7.6
1983	10	04	1852	-26.539	-70.503	24.6	7.7
1987	03	05	0917	-24.395	-70.102	45.3	7.6
1994	06	09	0033	-13.856	-67.489	631	8.2
1995	07	30	0511	-23.285	-70.103	46	8.0
1996	11	12	1659	-14.950	-75.532	21	7.7
2001	06	23	2033	-16.305	-73.550	29.8	8.4
2001	07	07	0938	-17.522	-71.938	17.4	7.6
2005	06	13	2244	-19.987	-69.197	115	7.8
2007	08	15	2340	-13.386	-76.603	39	8.0
2007	11	14	1540	-22.247	-69.890	40	7.7
2014	04	01	2346	-19.642	-70.817	20.1	8.2

TECTONIC SUMMARY

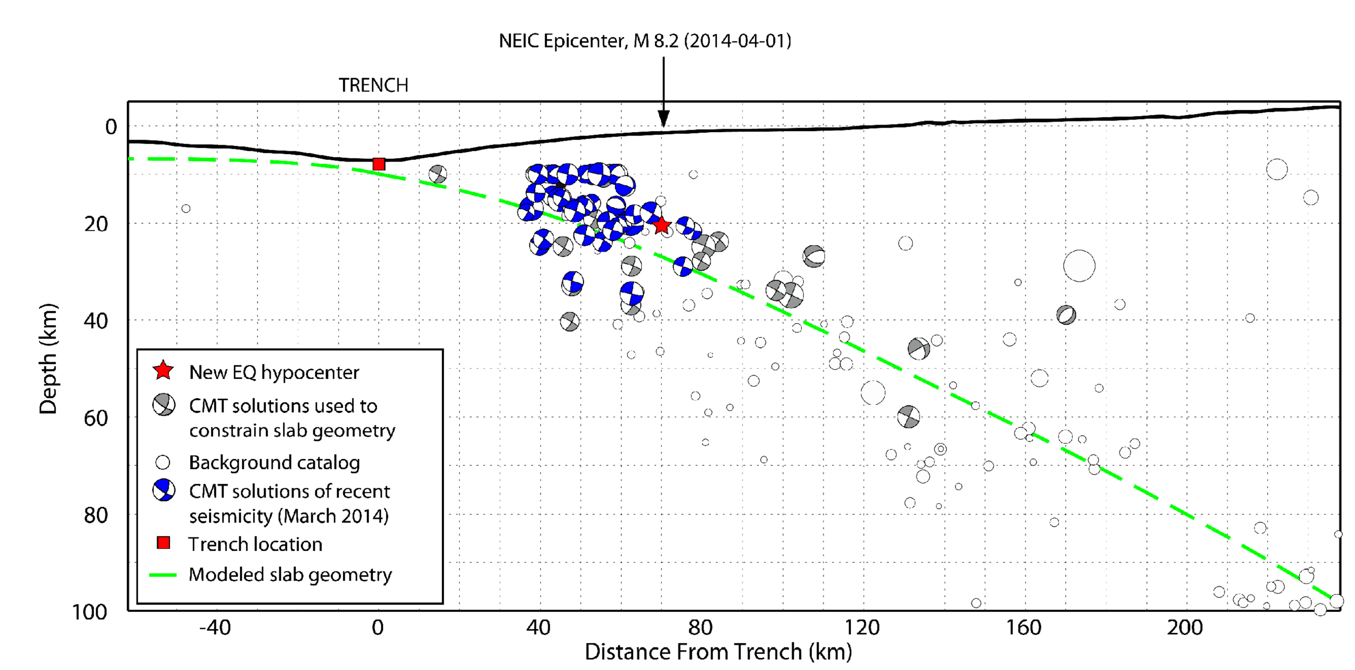
The April 1, 2014 M8.2 earthquake in northern Chile occurred as the result of thrust faulting at shallow depths near the Chilean coast. The location and mechanism of the earthquake are consistent with slip on the primary plate boundary interface, or megathrust, between the Nazca and South America plates. At the latitude of the earthquake, the Nazca plate subducts eastward beneath the South America plate at a rate of 65 mm/yr. Subduction along the Peru-Chile Trench to the west of Chile has led to uplift of the Andes mountain range and has produced some of the largest earthquakes in the world, including the 2010 M 8.8 Maule earthquake in central Chile, and the largest earthquake on record, the 1960 M 9.5 earthquake in southern Chile.

The April 1 earthquake occurred in a region of historic seismic quiescence – termed the northern Chile or Iquique seismic gap. Historical records indicate a M 8.8 earthquake occurred within the Iquique gap in 1877, which was preceded immediately to the north by an M 8.8 earthquake in 1868.

A recent increase in seismicity rates has occurred in the vicinity of the April 1 earthquake. An M6.7 earthquake with similar faulting mechanism occurred on March 16, 2014 and was followed by 60+ earthquake of M4+, and 26 earthquakes of M5+. The March 16 earthquake was also followed by three M6.2 events on March 17, March 22, and March 23. The spatial distribution of seismicity following the March 16 event migrated spatially to the north through time, starting near 20°S and moving to ~19.5°S. The initial location of the April 1 earthquake places the event near the northern end of this seismic sequence. Other recent large plate boundary ruptures bound the possible rupture area of the April 1 event, including the 2001 M 8.4 Peru earthquake adjacent to the south coast of Peru to the north, and the 2007 M 7.7 Tocopilla, Chile and 1995 M 8.1 Antofagasta, Chile earthquakes to the south. Other nearby events along the plate boundary interface include an M 7.4 in 1967 as well as an M 7.7 in 2005 in the deeper portion of the subduction zone beneath inland Chile.

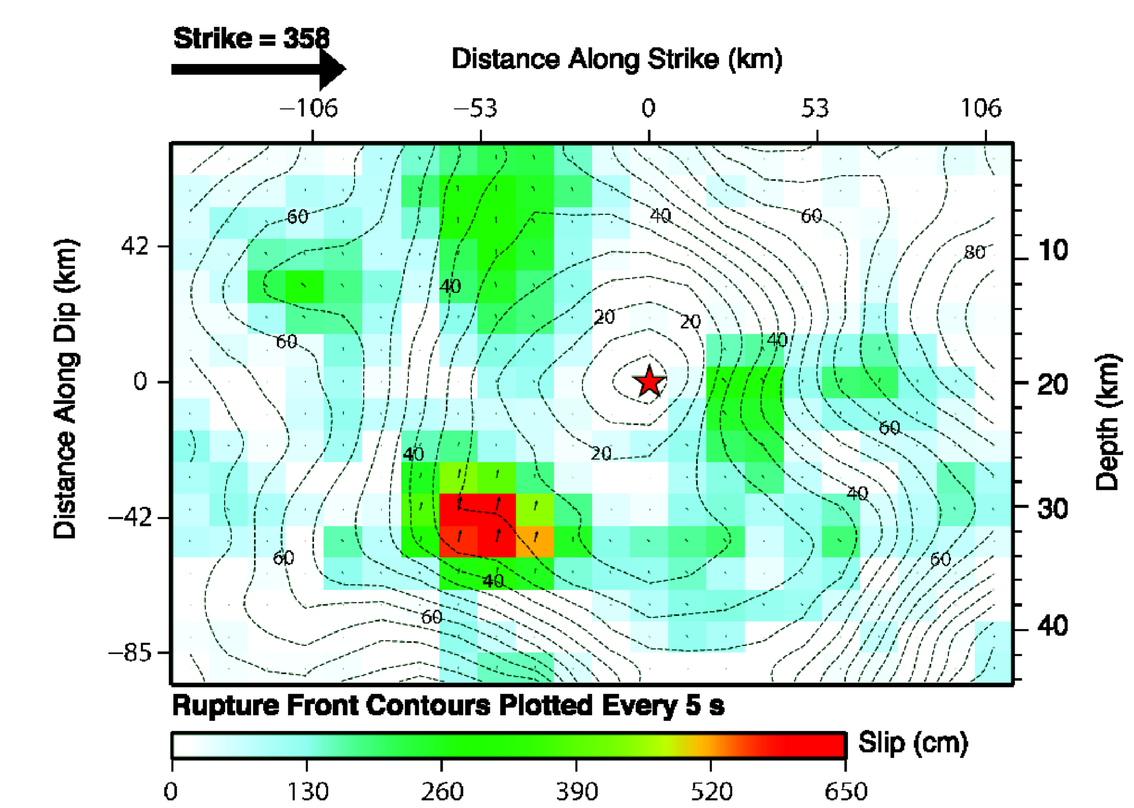
On April 3, 2014 a M 7.6 aftershock off the west coast of northern Chile occurred as a result of thrust motion at a depth of approximately 40 km, 23 km south of the city Iquique. The location and mechanism of the earthquake are consistent with slip on the plate boundary interface, or megathrust, between the Nazca and South America plates. At the latitude of the event, the Nazca plate is subducting beneath South America at a rate of ~73 mm/yr.

Depth Profile



Finite Fault Model

Distribution of the amplitude and direction of slip for subfault elements of the fault rupture model are determined from the inversion of teleseismic body waveforms and long period surface waves. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip is also colored by magnitude.The view of the rupture plane is from above. The strike of the fault rupture plane is almost directly North (358°) and the dip is 15°E. The dimensions of the subfault elements are 12 km in the strike direction and 10 km in the dip direction.The rupture surface is approximately 40 km along strike and 30 km downdip. The seismic moment release based upon this plane is 2.35e+28



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)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Hayes, G. P., Wald, D. J., and Johnson R. L., 2012, A three-dimensional model of globalsubduction zone geometries: Journal of Geophysical Research, v. 117, B01302, doi:10.1029/2011JB008524.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models

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 Villasenor, 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.

DISCLAIMER

Map updated by U.S. Geological Survey National Earthquake Information Center
3 April 2014
http://earthquake.usgs.gov/
Map not approved for release by Director USGS