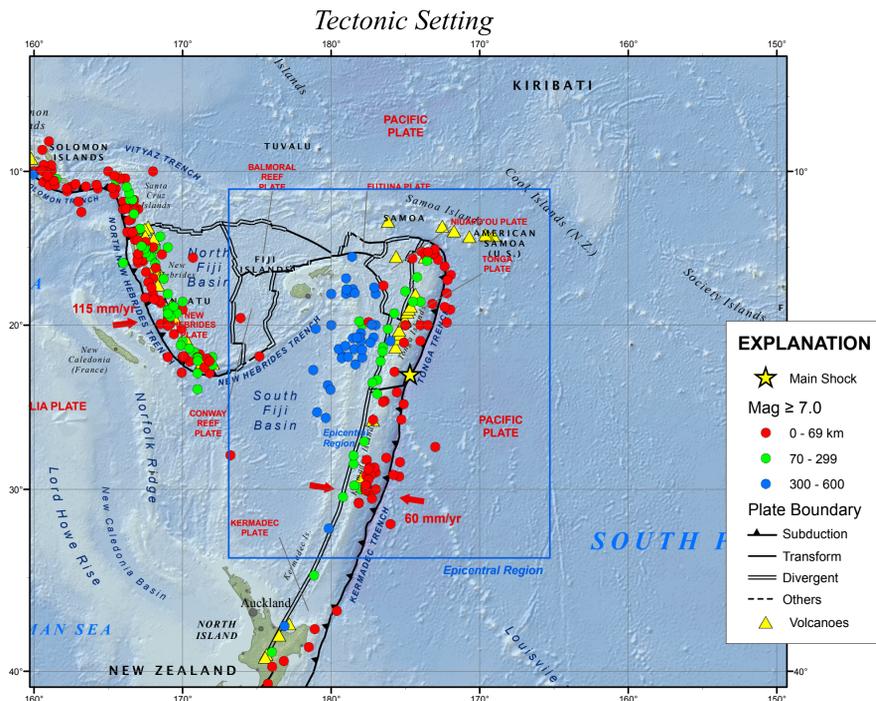
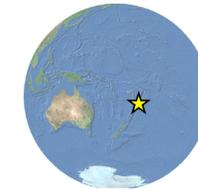


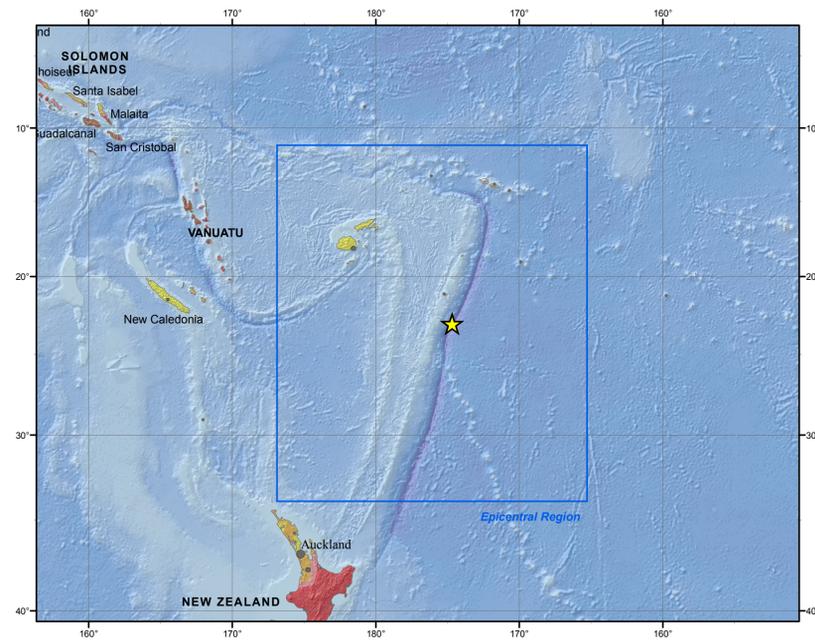
M7.6 Tonga Region, Earthquake of 19 March 2009



RELATIVE PLATE MOTIONS

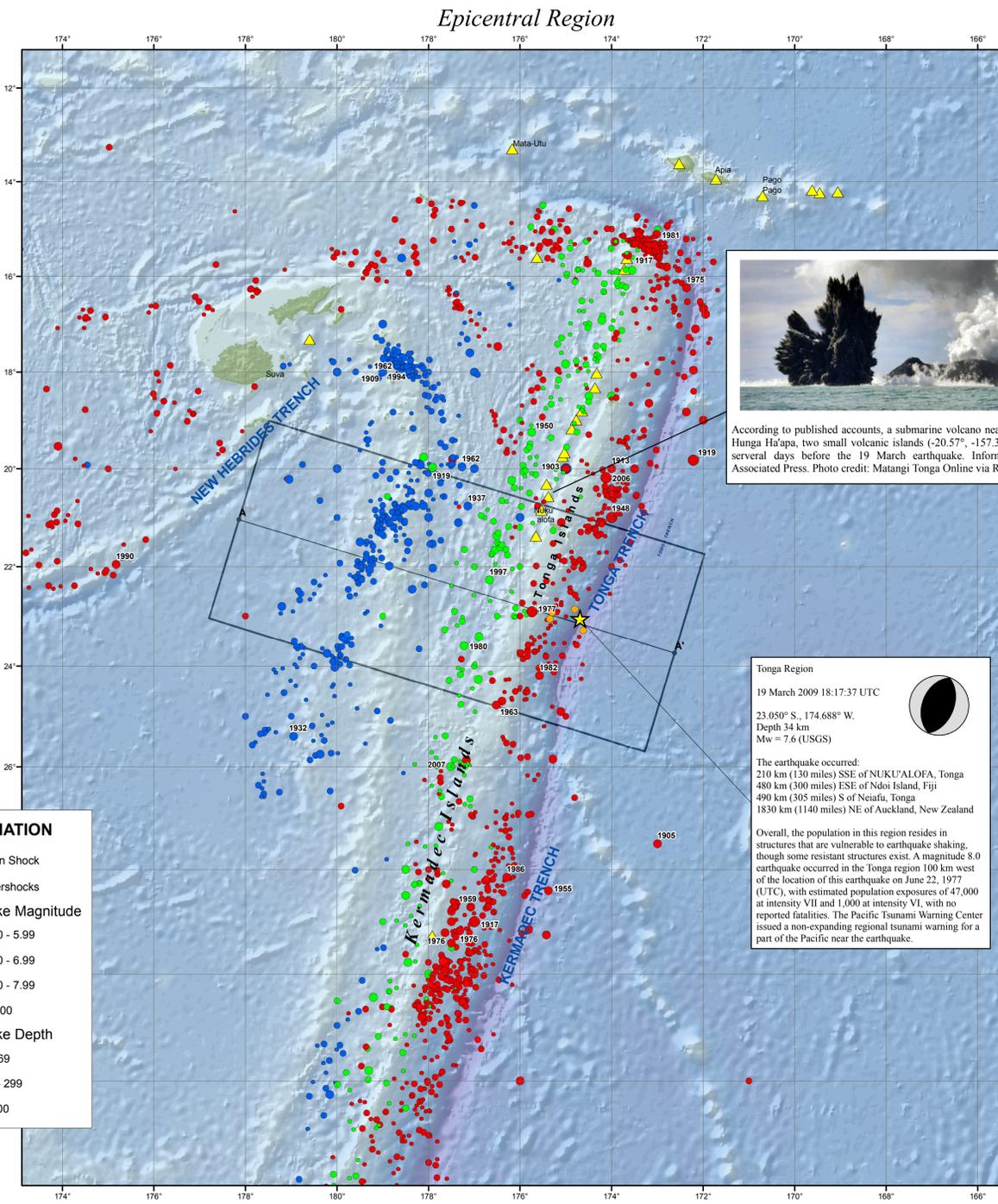
The broad red vectors represent the motion of tectonic plates relative to the adjacent plate. In the vicinity of this earthquake, the Australia Plate and Pacific Plate are converging at about 60 mm/yr. Many microplates are caught in this convergence. The Kermadec Plate is one of these.

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.

Peak Ground Acceleration in m/sec²



According to published accounts, a submarine volcano near Hunga Tonga and Hunga Ha'apa, two small volcanic islands (-20.57°, -157.38°), began erupting several days before the 19 March earthquake. Information source: The Associated Press. Photo credit: Matangi Tonga Online via Reuters.

Tonga Region
19 March 2009 18:17:37 UTC
23 050° S, 174.688° W
Depth 34 km
Mw = 7.6 (USGS)

The earthquake occurred:
210 km (130 miles) SSE of NUKU'ALOFA, Tonga
480 km (300 miles) ESE of Ndoi Island, Fiji
490 km (305 miles) S of Neiafu, Tonga
1830 km (1140 miles) NE of Auckland, New Zealand

Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 8.0 earthquake occurred in the Tonga region 100 km west of the location of this earthquake on June 22, 1977 (UTC), with estimated population exposures of 47,000 at intensity VII and 1,000 at intensity VI, with no reported fatalities. The Pacific Tsunami Warning Center issued a non-expanding regional tsunami warning for a part of the Pacific near the earthquake.

DISCUSSION

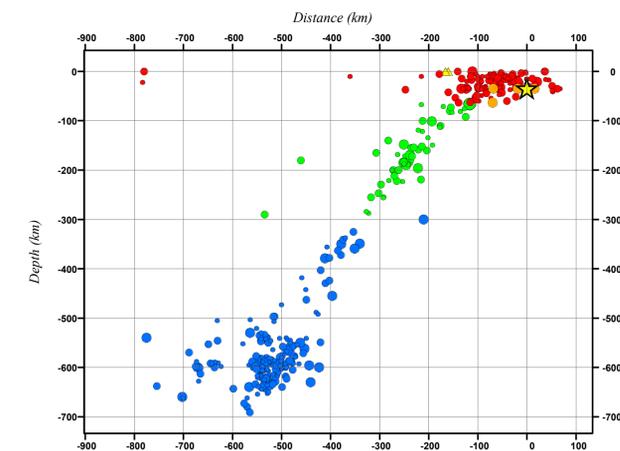
The March 19, 2009, M7.9 earthquake occurred in the Tonga - Kermadec subduction zone. The subduction zone extends north-northeast from the North Island of New Zealand for over 2500 km through Tonga to within 100 km of Western Samoa. The broad-scale tectonics of the earthquake region are dominated by the relative convergence of the Pacific and Australia plates. The Pacific plate subducts westward beneath the Australia plate at the Tonga trench. At the latitude of the earthquake, the Pacific plate moves westward with respect to the interior of the Australia plate at a velocity of about 71 mm/year. The eastern edge of the broad Australia plate may itself be viewed as a collection of small plates or microplates that move with respect to each other and with respect to the Pacific plate and the Australia plate interior. In terms of numbers of earthquakes, the broad-scale Australia/Pacific plate boundary is one of the most active in the world. Earthquakes occur on the thrust-fault boundary between the Australia and Pacific plates, within the Pacific plate, and within and on the boundaries of the small plates that together compose the eastern edge of the overall Australia plate. On the basis of currently available information, we infer that the earthquake of 19 March 2009 occurred on the interface of the Pacific and Australia plates.

The interaction between the Pacific and Australia plate creates one of the most active tectonic environments in the world, with a high level of associated earthquake activity. Since 1976, a 200-km long section of the Tonga - Kermadec subduction zone that includes the epicenter of the March 19 earthquake has produced over 50 earthquakes of magnitude 6 or larger, with the largest having magnitude 7.9.

Significant Earthquakes Mag ≥ 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1903	01	04	0507	-20.000	-175.000	400	8.0
1905	03	18	0058	-27.500	-173.000	60	7.5
1913	06	26	0457	-20.000	-174.000	0	7.7
1917	05	01	1826	-29.000	-177.000	0	8.0
1917	06	26	0549	-15.500	-173.000	0	8.5
1919	01	01	0300	-19.971	-177.914	202	7.7
1919	04	30	0717	-19.823	-172.215	35	8.2
1932	05	26	1609	-25.399	-179.049	568	7.5
1937	04	16	0301	-20.768	-177.144	348	7.5
1948	09	08	1509	-21.000	-174.000	0	8.0
1955	02	27	2043	-28.406	-175.379	17.9	7.8
1957	04	14	1918	-15.403	-173.129	35	7.5
1959	09	14	1409	-28.722	-177.079	35	7.8
1962	04	26	0726	-17.873	-178.683	551	7.5
1962	05	21	2115	-19.962	-177.272	416	7.5
1963	12	18	0030	-24.776	-176.520	35	7.7
1975	12	26	1556	-16.241	-172.364	15	7.7
1976	01	14	1556	-29.213	-177.638	43.7	7.8
1976	01	14	1647	-29.172	-177.316	31.7	7.9
1977	06	22	1208	-22.912	-175.744	65.5	8.1
1980	04	13	1804	-23.593	-177.225	148	7.6
1981	09	01	0929	-15.112	-173.019	14.2	7.5
1982	12	19	1743	-24.193	-175.575	31.6	7.5
1986	10	20	0646	-28.150	-176.291	26.7	7.7
1990	03	03	1216	-21.956	-175.171	35.5	7.6
1994	03	09	2328	-17.950	-178.417	563	7.6
1997	10	14	0953	-22.271	-176.672	169	7.7
2006	05	03	1526	-20.187	-174.123	55	8.0
2007	12	09	0728	-25.996	-177.514	152	7.8
2009	03	19	1817	-23.050	-174.668	10.0	7.9

Cross Section A-A'



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
20 March 2009
<http://earthquake.usgs.gov/>

DATA SOURCES and REFERENCES

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NOAA, National Geophysical Data Center
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PLATE TECTONICS

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BASE MAP

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