

WHAT IS AN EARTHQUAKE?

An earthquake is sudden slip on a fault, and the shaking caused by that slip. Faults are breaks in the rock of the Earth. In Nevada the active faults are in the crust, between the surface and a depth of about 16 kilometers (10 miles). As time goes on, active faults gradually accumulate stress and elastic energy. When the fault can no longer resist the stress, it breaks suddenly. Some of the elastic energy goes into the waves that shake the Earth. After large earthquakes, the crust readjusts rapidly around the fault that moved, causing smaller earthquakes known as aftershocks. Earthquakes also occur with volcanic activity, such as at Mammoth Lakes in California. This map shows the epicenters of earthquakes. An epicenter is the point on the Earth's surface above the place in the Earth where the earthquake originates. Fault rupturing and shaking from earthquakes commonly cover a much larger area than immediately around the epicenter.

EARTHQUAKES IN NEVADA

Nevada is ranked third in states having the most large earthquakes. Earthquakes occur throughout Nevada but have been concentrated in three seismic belts (see inset map). The Sierra Nevada-Great Basin seismic belt includes earthquakes along the eastern side of the Sierra Nevada and appears to be a northern continuation of the Eastern California seismic belt. The Sierra Nevada-Great Basin seismic belt is characterized by persistently high levels of earthquake activity. The Central Nevada seismic belt, which trends north-south in the west-central part of the state, includes the largest historic earthquakes in Nevada in the 20th century: the 1915 Pleasant Valley (M7.8), the 1932 Cedar Mountain (M7.2), the 1954 Fairview Peak (M7.3), and the 1954 Dixie Valley (M6.9) earthquakes. The magnitudes are the ones from the original catalog of Nevada earthquakes (Stiemmons and others, 1965) and newer magnitude estimates exist. Many of the smaller earthquakes in this belt are aftershocks of these large events. The Southern Nevada seismic belt is the least understood of the seismic belts and is characterized mostly by concentrations of background earthquakes (ones not associated with surface expression). Within it many earthquakes near the Nevada Test Site have been induced by nuclear blasts. Another earthquake area of note in Nevada is the Lake Mead area, where earthquakes may be partly "reservoir induced" by the filling of Lake Mead. Background earthquakes are shown throughout Nevada, but many others, especially in northern and eastern Nevada, occurred but were not recorded because of poor seismic network coverage. Although earthquakes don't occur at regular intervals, the statistical average of magnitude 6 or greater earthquakes in Nevada has been about one every 6 years, while magnitude 7 and greater earthquakes average approximately one every 30 years.

USE OF THE EARTHQUAKE MAP

The distribution of epicenters is sometimes used to anticipate the locations of future large earthquakes. However, the following points should be considered before making such judgments. The absence of earthquake activity at a particular location does not necessarily mean that earthquakes will not occur there in the future. Moderate to large earthquakes have often been preceded by periods of seismic quiescence. The time represented here (~150 years) is far too brief to include all areas of previous earthquake activity. There are many faults where geologists can see evidence of major prehistoric earthquakes, but where there are not any earthquakes on this map. Nearly every mountain range in Nevada is bounded on one or both sides by a fault that had produced earthquakes in the geologic past and may be capable of producing earthquakes in the future. The philosophy of this map is to include all earthquakes recorded in Nevada, regardless of the quality of location or magnitude. The quality diminishes with increasing time before present and increasing distance from seismic monitoring stations, most of which are in western and southern Nevada.

SOURCES OF THE DATA

This map shows all earthquakes known to have occurred in Nevada from the 1850s to 1998. The principal source of data is the catalog developed by the Nevada Seismological Laboratory at the University of Nevada, Reno. Additional earthquakes in southern and eastern Nevada were identified from the Southern Nevada Seismic Network Catalog associated with the Nevada Test Site (1978-1993) and the University of Utah Seismographic Station Catalog (1850-1996), respectively. When the same earthquake was located by more than one network, the preferred location shown on this map was determined by considering which network had the best station coverage. Artificial events, such as mine blasts, nuclear explosions, and hole collapses following nuclear explosions, have been removed whenever recognized. However, earthquakes induced by filling reservoirs, triggered by nuclear explosions or by other earthquakes inside or outside Nevada, or by other causes are included.

It is important to recognize that the earthquake catalogs are not complete. The completeness of the catalogs has generally, but not always, improved through time. Seismic networks are sometimes installed for special purposes and removed or rearranged when the study has been completed. Prior to 1887, there were no seismographic stations operating in Nevada, and there were few until the 1960s. Earthquakes from 1850 to 1900 were located and magnitudes estimated from historical reports (Topozada and others, 1981; dePolo and others, 1997). The locations of these earlier events are not precisely known and the major events are plotted with question marks. From 1900 until the 1970s locations depend heavily on data from stations outside of Nevada, with some contribution from local information. The early part of this earthquake catalog (through 1960) was compiled by Stiemmons and others (1954 and 1965). Magnitudes for the larger events from Stiemmons and others (1965) are generally near the upper limits of magnitude ranges associated with those earthquakes. The Nevada Seismological Laboratory established its network in the 1970s and consolidated with the Southern Great Basin Seismic Network in 1993. During this period, locations are generally well constrained in western Nevada and adjacent parts of California between the latitudes of Reno and Goldfield. Network coverage in northern, eastern, and parts of southern Nevada has never been thorough; in these regions only the larger earthquakes have been recorded. This can be seen on the map, especially in northern and eastern Nevada, where the numbers of earthquakes with magnitudes greater than 4 are similar to the number of earthquakes with magnitude under 4. Wherever network coverage is more complete the smaller earthquakes outnumber the larger ones by a ratio of more than 10 to 1. Thus the map can be considered complete above about magnitude 7 since 1850, above about magnitude 5.5 for all of Nevada since 1900, above about magnitude 4.0 for all of Nevada since 1940, above magnitude 3.0 for the instrumented parts of Nevada since 1970, and above magnitude 2.0 for instrumented areas since 1980 (Savage and dePolo, 1993). Locations and magnitudes of the major earthquakes outside of Nevada are from Real and others (1976), Arabasz and Smith (1979), and Topozada and others (1981).

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EARTHQUAKES IN NEVADA  
WITH MAGNITUDES OF 5.5 OR GREATER

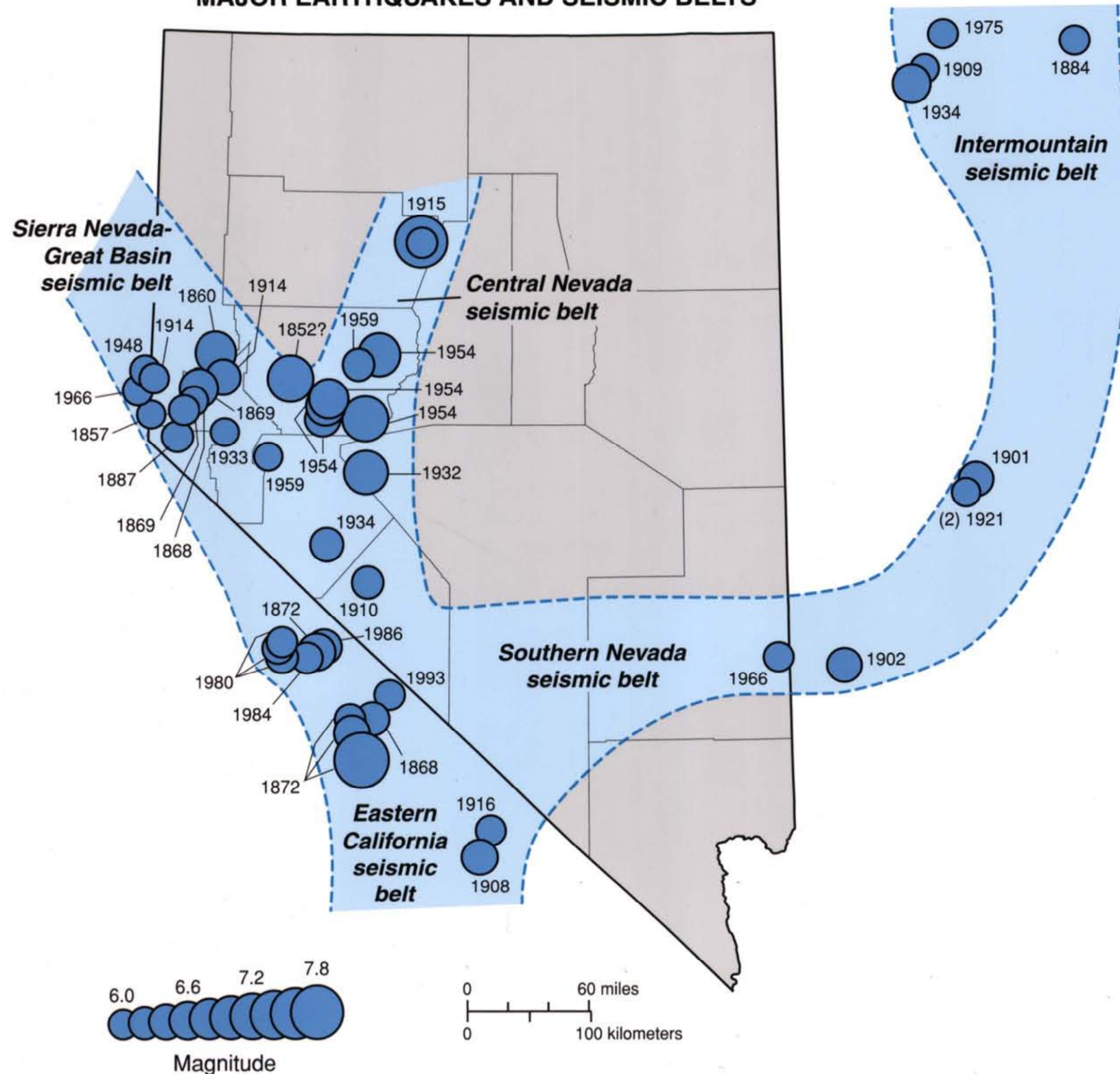
Year	Month	Day	Time GMT	North Latitude*	West Longitude*	Magnitude	
1852?	?	?	?	?	39 30.007	118 43.007	7.3?
1857	Sep	03	?	?	39 18.007	120 00.007	6.2?
1860	Mar	15	1845	39 41.007	119 25.007	7.0?	
1868	May	30	0511	39 21.007	119 37.007	6.0?	
1869	Dec	27	0130	39 26.007	119 34.007	6.7?	
1869	Dec	27	0550	39 30.007	120 00.007	5.5?	
1869	Dec	27	0940	39 17.007	119 42.007	6.1?	
1872	Mar	23	2141	40 00.007	117 30.007	5.9?	
1873	Nov	05	1700	40 00.007	118 00.007	5.5?	
1875	Apr	02	0200	39 30.007	115 48.007	5.5?	
1887	Jun	03	1048	39 05.007	119 46.007	6.3?	
1894	Nov	18	1049	39 12.007	119 30.007	5.5?	
1905	Nov	11	2126	42 54.00	114 30.00	5.7	
1910	Nov	07	1720	37 30.00	117 00.00	5.5	
1910	Nov	19	0025	38 00.00	118 00.00	5.5	
1910	Nov	21	2323	38 00.00	118 00.00	6.1	
1910	Nov	22	0605	38 00.00	118 00.00	5.5	
1914	Feb	18	1817	39 30.00	120 00.00	6.0	
1914	Apr	24	0834	39 31.00	119 21.00	6.4	
1915	Oct	03	0149	40 30.00	117 30.00	6.1	
1915	Oct	03	0653	40 30.00	117 30.00	7.8	
1916	Feb	03	1503	41 00.00	117 48.00	5.9	
1916	Aug	03	1350	41 30.00	116 30.00	5.8	
1916	Aug	03	1421	41 30.00	116 30.00	5.8	
1932	Dec	21	0610	38 48.00	117 58.80	7.2	
1932	Dec	25	0355	38 48.00	118 00.00	5.5	
1933	Jan	05	0651	38 46.20	117 44.40	5.9	
1933	Feb	13	2209	38 00.00	118 00.00	5.5	
1933	Jun	25	2045	39 06.00	119 18.00	6.0	
1933	Oct	27	1059	38 54.00	117 36.00	5.5	
1934	Jan	30	1924	38 18.00	118 24.00	5.6	
1934	Jan	30	2016	38 18.80	118 22.20	6.3	
1934	Jan	30	2030	38 18.00	118 24.00	5.7	
1934	Feb	09	0921	38 18.00	118 24.00	5.5	
1934	Jun	23	1954	39 06.00	118 30.00	5.5	
1939	May	11	1840	38 36.00	117 48.00	5.5	
1942	Dec	03	0944	39 42.00	119 18.00	5.9	
1942	Dec	17	1507	38 43.80	119 40.80	5.5	
1943	Aug	09	0530	38 12.00	118 12.00	5.5	
1948	Dec	29	1253	39 33.00	120 04.80**	6.0	
1949	Feb	11	2105	36 58.98	117 48.30	5.6	
1953	Sep	26	0334	39 31.80	119 58.80	5.5	
1954	Jul	06	1113	39 17.40*	118 21.60*	5.6	
1954	Jul	06	1118	39 25.20	118 31.80	5.5	
1954	Jul	06	1149	39 25.20	118 31.80	5.7	
1954	Jul	06	2207	39 12.00*	118 24.00**	6.0	
1954	Aug	24	0551	39 21.00*	118 20.40**	5.8	
1954	Aug	31	2220	39 36.00	118 12.00	5.8	
1954	Sep	01	0518	39 36.00	118 12.00	5.5	
1954	Dec	16	1107	39 12.00*	118 00.00**	7.3	
1954	Dec	16	1111	39 40.20**	117 52.20**	6.9	
1954	Dec	16	1416	39 30.00	118 00.00	5.8	
1955	Nov	21	2025	39 25.20	118 04.80	5.5	
1959	Mar	23	0710	39 36.00	118 04.20	6.3	
1959	Jun	23	1435	38 55.20	118 53.40	6.3	
1959	Jun	23	1504	39 06.00	118 48.00	5.5	
1962	Aug	30	1335	41 48.00	118 48.00	5.8	
1964	Mar	22	1630	38 42.00	118 48.00	5.5	
1966	Aug	16	1802	37 27.78	114 09.08	6.0	
1966	Sep	22	1857	37 22.14	114 10.98	5.8	
1992	Jun	29	1014	36 43.26	116 17.64	5.6	
1994	Sep	12	1223	38 48.50	119 38.30	5.9	

\* In degrees and decimal minutes

\*\* From Doser (1986)

\*\*\* In California next to the Nevada border.

MAJOR EARTHQUAKES AND SEISMIC BELTS



EARTHQUAKES  
IN NEVADA  
1852-1998

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