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EARTHQUAKE HISTORY OF ARIZONA AND NEW MEXICO, 1850-1966<sup>1/</sup>

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A tabulation of some 215 earthquakes which have occurred in the Southwestern states of Arizona and New Mexico from 1850-1966 has been made. Also included are those quakes that may have been near the borders, especially for those of the nineteenth century when precise locations were not available. The list was compiled using previously published records and newspaper reports.

The states of Arizona and New Mexico are surprisingly inactive from a seismic viewpoint, especially when compared to neighboring states. Still, there have been earthquakes in both states and by no means can the states be considered as tectonically inactive. This paper lists the earthquakes found in the literature during the period 1850 to 1966. In several cases, earthquakes which occurred in the nineteenth century, and may have been centered in California or Sonora, Mexico, are included due to the imprecise records from that period of time.

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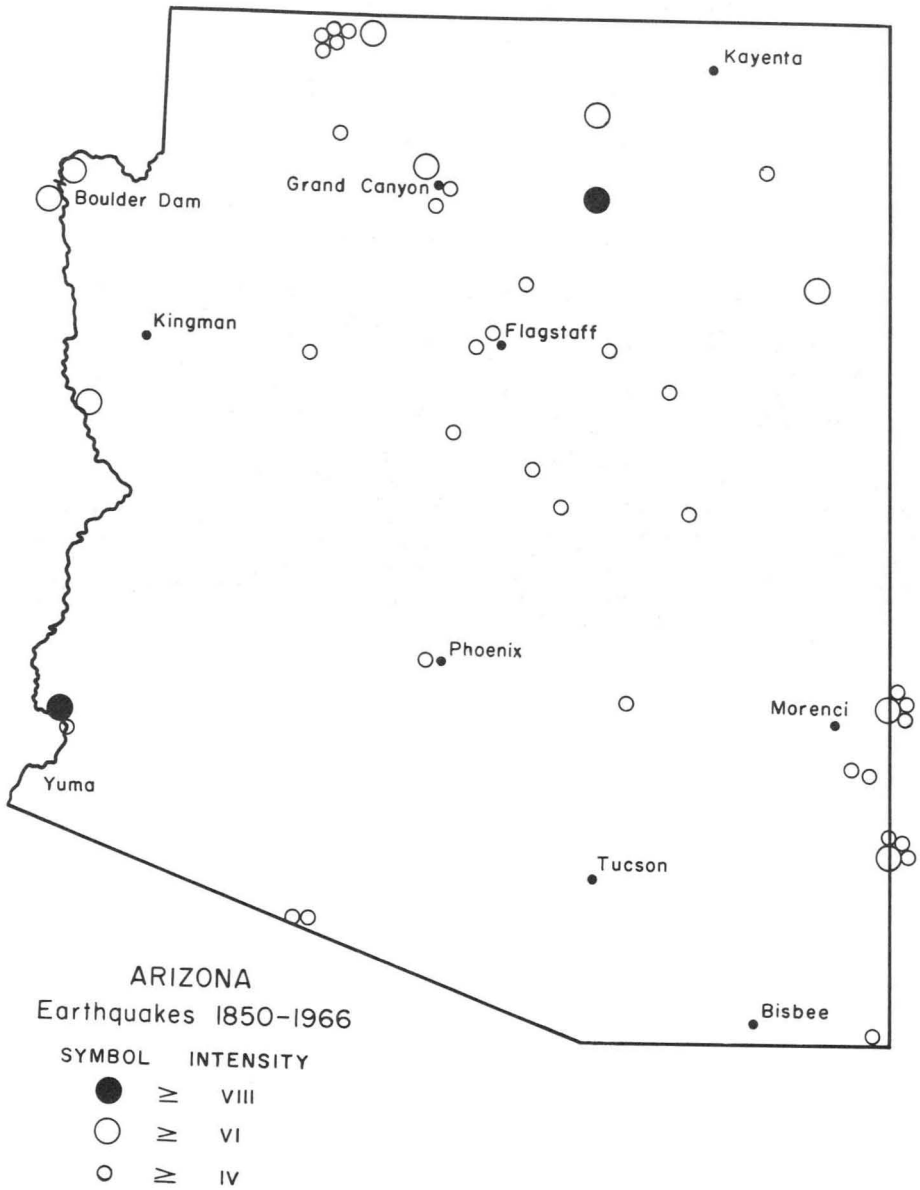


Figure 1.--Location Map of Earthquake Epicenters in the State of Arizona for the Period 1850-1966.

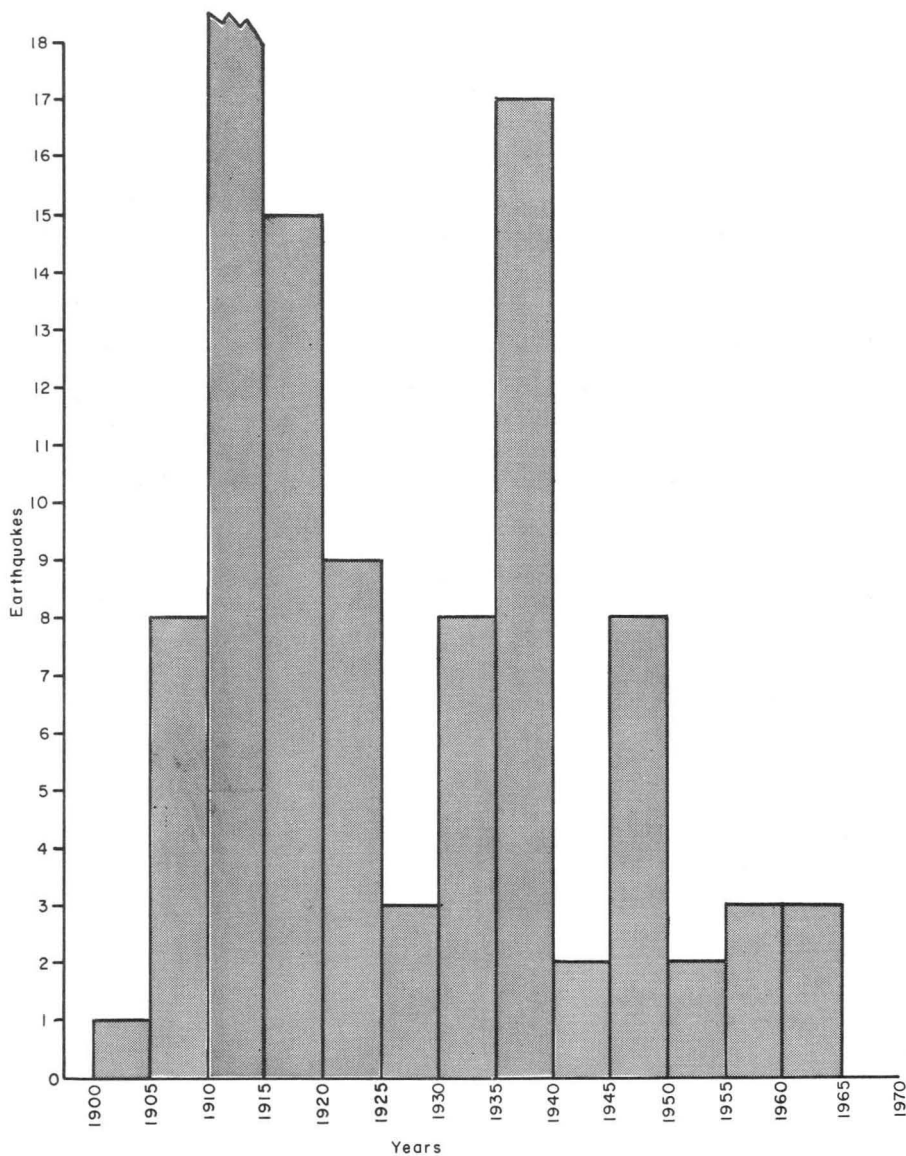


Figure 2.--Bar Graph Illustrating Yearly Record of Earthquakes with Epicenters Proven or Thought to be in Arizona for the Period 1900-1966.

NO. YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
1	1850	8/4	San Diego, Calif. & on the Gila	V	S.S., v. 29 pg. 293-297	
2	1852	11/9	Fort Yuma, Calif. 33°N 114°W	VIII-IX	E.Q. Hist. of U.S. pg. 60	Violent shock at Fort Yuma threw down portions of chimney peak. Fissures and cracks opened in clay desert bordering the Colorado River. Fort Yuma was at this time on the California side of the Colorado River. Shocks almost daily for many months.
3	1853	Dec.	Fort Yuma, Calif. 36 $\frac{1}{2}$ °N 118°W	X-XI	E.Q. Hist. of U.S.	Many shocks. Possibly of de- structive force. Felt area 125,000 sq. miles.
4	1869	9/5	Arizona, Calif. (Sic.)		S.S., v. 29 p. 293-297	
5	1870	3/11	Prescott, ? California		" "	
6	1872	3/26	Owens Valley, California		E.Q. Hist. of U.S. pg. 61	This destructive shock was felt over most of Arizona, California, and Nevada.
7	1875	12/15	15:45	Maricopa Wells	S.S., v. 29 p. 293-297	
8	1877	9/7	23:00	Yuma	" "	8 second duration
9	1878	12/17	17:00	Yuma	" "	Light shock
10	1884	9/26	23:53	Yuma	" "	Light shock
11	1884	9/27	16:00	Yuma	" "	Light shock
12	1887	5/3	15:48	Tombstone (Cochise Co.)	" "	Center near Sonora, Old Mexico. In Science, 1887, May 20, p. 483, under the heading, "The Sonora Earthquake," is a good account by G. E. Goodfellow, of the shock at Tombstone, Ariz. At this place there were loud detonations. The severe shaking lasted ten seconds, the moderately severe about twenty

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13	1887	5/7	14:13	Bavispe, Sonora, Mexico	VIII-IX	E.Q. Hist. of U.S. p. 56	<p>and tremors a little over one minute. No building of any stability was damaged, and no person was injured. The railroad track of the A.T. and St. F.R.R., at a point where it ran east and west, was thrown four and a half inches out of line, the convexity looking south. The bend was 300 feet long. For 48 hours after the shock there were tremors. Miners 600' below the surface felt the shock severely and some became sick. Miners 150' below the surface noticed the shock less. The area of disturbance is estimated at 1,200 by 600 miles. In Fronteras Valley, Sonora, Old Mexico, and the neighborhood, the shock was destructive to houses and to human life. Fissures north and south were produced. The center is probably south of Fronteras. At San Bernardino Ranch, 90 miles southeast of Tombstone, all the houses were thrown down. There are extinct craters at this place.</p> <p>Epicenter not accurately known. Seismic movements were felt from Toluca, near Mexico City, to Albuquerque and Santa Fe on the north, from Guaymas and Yuma on the west to a point 60 miles east of El Paso on the east. "From Guaymas to Nogales, Benson, Tucson El Paso, and at places as far away as Albuquerque, water in tanks sloped over, cars were set in motion on the tracks, chimneys were thrown down, and buildings cracked. Mr. Goodfellow was at Tombstone and felt the tremors and heard sounds like prolonged artillery fire coming from the south and dying away to the north." (P. 56, E.Q. Hist. of U.S.)</p>

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14	1887	5/30	14:00	Benson & Nogales		S.S. v. 29 p. 293-297	
15	1892	2/23	24:00	Yuma		" "	Two shocks. No damage. Movement E → W.
16	1899	12/25	05:25	Seligman		" "	The heavy San Jacinto shock was felt in W. Arizona.
17	1903	1/23	22:30	Yuma		" "	A heavy jolt or shake occurred.
18	1903	1/23	23:00	Phoenix		" "	Slight shock. This and the preceding shock were probably the same.
19	1906	1/25	14:40	Phoenix & Flagstaff 35.3°N 111.6°W	VII or VIII	S.S. v. 29 p. 293-297, E.Q. Hist. of U.S.	Felt area 15,000 sq. mi. Felt from Seligman, Arizona to Gallup, N.M., and was most severe at Flagstaff. A lighter shock occurred at 7:30 & another at 10:00 a.m. 1/26. Crockery was smashed and plaster and some chimneys fell at Flagstaff.
20	1906	1/28	22:15	Flagstaff	II to III	S.S. v. 29	
21	1906	4/18	06:48	Phoenix		" "	Slight shock motion W → E
22	1906	4/18	06:59	Phoenix	II to III	" "	
23	1906	4/18	17:30	Yuma		" "	Slight rolling vibration from E → W
24	1906	7/16	12:50	Douglas, Cochise County		" "	Three distinct shocks. Felt strong on second floor. Socorro, New Mexico.
25	1910	9/10 9/23		Cocconino Forest, 45 mi. N. Flagstaff 36°N 111.1°W	VIII	" "	Felt area 45,000 sq. mi. Coconino Forest, 45 mi. north of Flagstaff. A construction crew at work in the forest broke camp and returned to Flagstaff as a result of the cumulative terror caused by a series of 52 shocks in the interval 9/10 to 9/23, which rolled boulders down on their camp from the nearby mountain and grew in intensity until 9/23 at 9:05 p.m.,

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26	1912	8/18	22:10	N. of San Francisco	VI-VII	S.S. v. 29	<p>when a strong shock was felt throughout northern Arizona. This shock was reported from Flagstaff, Jerome, Kingman, Williams, and Winslow, and was reported to have been so strong in the section north of the San Francisco Mountains that the Indians fled from the region in terror. Numerous press dispatches, 9/24 - 9/28, 1910; Reid's Scrapbook, 3, p. 104.</p> <p>"Felt area 55,000 sq. mi. north of San Francisco Mountains. A shock on 8/18 recorded at a number of seismographic stations, and from accounts in Northern Arizona papers, was very severe in Coconino County north of Flagstaff. Indians reported an earth crack 50 miles long north of the San Francisco range, parallel to the Tuba Road at a distance of 5 miles. During the shock the earth in that region is said to have rolled "like waves in the Colorado River, while rock slides roared down the mountains. The shock was strong, but seems to have done no harm in the region traversed by the Santa Fe Railroad, and was reported from Ashford, Holbrook, Kirkland, Seligman, and Williams, Arizona, and Gallup, New Mexico - BSSA, 2, 269; BSSUC, 1, 76; Arizona papers."</p>
27	1912	8/19	03:00	Flagstaff		S.S. v. 29	Slight.
28	1913	12/5	17:15	Williams, Coconino County, 34.1°N, 109.8°W			Reported felt throughout Arizona and New Mexico.

NO. YEAR	DAY HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
29	1915 4/17 05:40	Eastern Arizona 34.3°N 110.2°W	V	E.O. Hist. of U.S., p. 51-64	A widely felt shock in eastern Arizona, especially at White River, Snowflake, and Standard. Felt in area of 3,500 square miles.
30	1915 6/22 20:59	Yuma 32.8°N 115.5°W	Mag. 6 $\frac{1}{2}$ Int. at source III	E.O. Hist. of U.S., S.S. v. 29	Two shocks in Imperial Valley, Calif., 7:59 p.m., and shock 8:56 p.m., Calif. time. First one felt in Yuma and Parker, Arizona.
31	1915 6/27 01:30	Mesa, Maricopa Co.	III	S.S. v. 29	
32	1915 10/2 22:54	Pleasant Valley, Nev.	X	E.O. Hist. of U.S., p. 57	Felt area 500,000 sq. mi. Felt from Baker, Oregon, to San Diego, Calif., and from the Pacific Coast to beyond Salt Lake City.
33	1915 11/20 16:13	(Yuma) Imperial Valley, Calif. 34°N, 110°W	VI	E.O. Hist. of U.S.	People frightened; clocks stopped. Felt area 70,000 sq. miles. Felt in Yuma, Arizona.
34	1916 3/29 21:47	Nogales, Santa Cruz, County	III	S.S. v. 29	
35	1916 12/12 05:45	Navajo and Apache Co.	V	E.O. Hist. of U.S. and S.S. v. 29	Navajo and Apache Counties. In Navajo County, Fort Apache, V, duration 3 sec.; Henry's Camp, V, awakened people, duration 7 sec.; Holbrook, V, duration 15 sec.; Pinedale, V, duration 6 sec.; Shumway, V, duration 3 sec.; Snowflake, IV (plus?), awakened people. In Apache County, the intensity was V at Pinto, where doors slammed and the shock lasted fifteen seconds; at St. Michaels, plaster was cracked, intensity V. Felt also at Thatcher, Graham Co.



NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
36	1917	5/27	7:00 P.M.	Yuma		S.S. v. 29	"A distinct jar. There may have been an error in time. A strong shock was felt in the Imperial Valley, Calif., at 10:06 p.m. on this date. BSSA, 7, 74."
37	1918	2/11	18:25	Rio San Pedro Valley		"	"Shocks recorded instrumentally and located by Turner at 32.2 N, 110.1W, in the San Pedro Valley. Not reported felt so far as known, although they must have been noticed. CE 1918-1924, BSSA."
38	1918	2/12	11:44am 11:55 " 12:04pm 12:09 " 12:19 "	Rio San Pedro Valley		"	
39	1918	4/20	01:45	Flagstaff, Coconino Co.	II	"	"Two shocks lasting a few seconds."
40	1918	4/21	15:32	W. Arizona		"	The severe San Jacinto shock of 4/21 was felt in Western Arizona. It was reported as felt at Gatman, Kingman, and Seligman.
41	1918	4/28	05:20	Flagstaff	II and V	"	First shock a single bump, felt by a few; second, a slight rocking-duration, 15 seconds.
42	1918	4/30	21:32	W. Arizona	IV	"	The severe shock which occurred in Imperial Valley at 8:32 p.m. was felt in Western Arizona. An intensity of IV was reported at Yuma.
43	1919	5/23	04:05	Flagstaff	III	"	Duration a few seconds.
44	1919	9/29	Various	S.W. Arizona		"	On this date several earthquakes were felt in the Imperial Valley, California, and Laguna Dam and Potholes on the Colorado River. Some of these were without doubt felt in the southwestern part of Arizona, but we have no records at hand showing positively that this is the case. There was a series of shocks, extending from 9/29 to 10/4, felt in this region.

NO. YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
45	1920	5/30	13:51 San Pedro Valley, 32.2°N 110.1°W		S.S. v. 29	Recorded at 16 stations.
46	1920	6/4	08:29	"	"	First shock recorded at 11 stations Second shock recorded at 5 stations
47	1920	12/19 12/20 12/21	S.W. Ariz.	"	"	Several rather strong shocks were felt in the Imperial Valley and on the Colorado River on 12/19, 20, and 21. Some of these must have been felt in southwestern Arizona.
48	1921	3/24	17:33 S.W. Ariz. 33.6°N 111.4°W	III or IV	"	Located by Turner at 33.6 N, 111.4 W in the Salt River Valley. Recorded at 25 stations.
49	1921	3/26	16:11	III	"	Duration 7 seconds, felt by several.
50	1921	4/6	02:07 Holbrook, Navajo Co.	VI	"	Holbrook, Navajo County. Plate Glass window broken, windows and dishes rattled, furniture moved; duration 30 seconds. Felt from Winslow on the west to Gallup, New Mexico, on the east. In Apache County, two shocks of in- tensity V were felt at Pirtto, in- tensity V lasting about 15 seconds; at St. Michaels, the intensity was also V, the duration 5 seconds.
51	1922	6/16	05:40 08:20 14:01	IV III V	"	Three shocks, felt by many, and the last by everyone.
52	1922	6/16	14:01	V	"	Rumbling; five shocks. Another shock at 14:25.
53	1922	6/17	16:42 Gila Co., Arizona	V	"	At Payson, a shock lasting 60 sec. and accompanied by rumblings was felt by many. At Roosevelt, the duration was 5 or 10 seconds; otherwise, as at Payson. At Young

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
54	1922	9/30	16:35	Rio San Pedro Valley		S.S. v. 29	two shocks of 3-4 seconds duration were felt by many. The intensity was about V. At Natural Bridge, a shock with loud sounds was noticed by many.
55	1923	9/30	11:30	Gila County	IV	"	Located by instruments, no perception reported.
56	1923	11/1	13:02	Salt River Valley 33.6°N 111.4°W		"	Two shocks of intensity of IV at Pine; two shocks of intensity II and duration 2 sec.; felt by several at Roosevelt; IV and short duration at Payson; IV at Gisela. The times given varied from "about 11 to 11:45," the time at Roosevelt is the only one not given in "round numbers" - it was 11:27.
57	1923	11/5	15:07	Imperial Valley, Calif.		"	Not perceived. Recorded by 16 stations.
58	1924	5/20	18:29	Salt River Valley 33.6°N 111.4°W		"	A heavy shock was felt in the Imperial Valley, California, on November 5. Reid states that it was felt in Arizona, but does not give the authority for the statement.
59	1924	6/18	10:31	"		"	Shock recorded at eight seismograph stations, not reported felt.
60	1927	1/1		Yuma	Mag. 5-3/4 to 5-1/2	"	Same as last entry.
61	1927	1/16	12:05	Yuma	IV	"	Imperial Valley. Felt in Arizona. Intensity V or VI in the Imperial Valley.

NO. YEAR	DAY	HR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
62	1927	2/10 20:40	Nogales, Pima Co.; Patagonia, Santa Cruz, Co., Arizona	II	S.S. v. 29	
63	1927	2/12	Yuma		" "	California quake.
64	1927	9/5 15:20	Yuma	III	" "	California.
65	1927	9/11 7:21pm	Picacho, Arizona		" "	"A gigantic gash, reported to be 400 yards long and in places, five feet in width, has appeared 3 mi. east of Picacho, about 70 miles southeast of Phoenix. This is said to be the result of an earth movement, although no record or a disturbance has been noted in the vicinity." BSSA, 17, 199.

A. K. Ludy, magnetic observer at Tucson, and Professor A. E. Douglass, Director of the Seward Observatory of the University of Arizona, inspected this crack on Sept. 15 and 16, 1927. Mr. Ludy made a report to the U. S. Coast and Geodetic Survey, and the following extracts are from his report. "The crack in the ground is about 1200 feet long, extends in general in a straight line, has a width of from 1/4" to 1' and a depth of 6'. In places where the edges have caved in, the width at the top is as much as 3'. The crack takes a direction about 20° east of south. But one side crack was observed, extending at right angles to the main crack for about 12' with a width of 1/4". The crack is located about 3 miles east of Picacho. It crosses the Southern Pacific Railway .6 of a mile west of the signboard designating the siding known as Ocotilla. The soil is loamy alluvial, probably very deep. There is no habitation near. About

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66	1928	7/18		Yuma	Slight	S.N. v 18 n 3, p. 237	4 miles east of the crack is a road camp of the Arizona State Highway Department. Mr. A. G. Sawyer and others at the camp were interviewed regarding the crack. Mr. Sawyer fixed the time of occurrence of the crack as between 8:00 p.m., 9/11, and 7:00 a.m., 11/12 (Mountain Time). He says that neither he nor any others at the camp felt any tremors nor heard any sounds other than the heavy thunder which was crashing during the night. A severe rain-storm had been in progress all the previous day and all that night, and the desert was completely covered with water at the time the crack opened. The crack disturbed the ballast of the railway and opened a crack across the highway which necessitated repairs. "An earthquake was recorded at Tucson at 8:21 p.m. (105 Meridian time), 9/11, distant 170 miles from the observatory. The evidence indicates that the crack is the result of this earthquake, although the crack is located a considerable distance from the seat of the earthquake." According to Professor Douglass, it has not been possible to find the crack for 5 or 6 years preceding 1937.
67	1928	7/18		Yuma	Slight	S.N. v. 21 p. 189	One second duration.
68	1930	7/16	12:00 14:00	Constellation III		S.N. v. 20 n 4, p. 274	Whittier, Calif. Quake recorded at Tucson, U. S. Coast and Geodetic Survey. Two shocks, were accompanied by heavy rumbling.

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69	1931	7/28	01:35	Cottonwood & Clemenceau & Jerome, Ariz. 34.7°N 112°W	IV-V	S.N. v 21 n 3, p. 236, S.N. v 21 n 4, p. 291	Broke dishes. "An earthquake of intensity IV-V was felt in Jerome at 1:35 a.m. on July 28th. It was also felt in Peoples Valley with intensity III."
70	1932	2/7	23:30	Perkinsville, Arizona		S.N. v 23 n 1, p. 26	An earthquake was felt at Perkinsville.
71	1932	12/29	22:15	Yuma & Somerton, Ariz.	III-IV	S.N. v 23 n 3, p. 129	Brief. The movement was described as a sharp jolt; windows rattled.
72	1934	1/4	13:53	Yuma		S.N. v 24 n 2, p. 138	Was felt.
73	1934	5/14	06:17	Yuma	III	Abstracts	Abrupt southwest to northeast jolt; felt by many; "too short to set up vibrations apparently hardly rattled the windows."
74	1934	12/5	05:20	Fredonia, Arizona	IV	Abstracts	Rapid motion began abruptly and lasted about 5 seconds; felt by and awakened many, frightened few.
75	1934	12/31	10:45	Bajg, Calif. 32°N, 114 3/4°W	Mag. 7.1	E.O. Hist. of U.S. p. 51	Felt area 80,000 sq. miles. Felt in Arizona and Nevada. Intensity V in Tucson; IV in Phoenix.
76	1935	1/1	01:50	Grand Canyon, Arizona	V	Abstracts	One of several shocks, followed by shocks on 1/4, 1/5, and 1/10, strong enough to break windows and arouse sleepers. "First shock in 20 years."
77	1935	1/2	00:38	Wellton, Ariz. 34.8°N 114.2°W	VI	E.O. Hist. of U.S. p. 51	Local. Some cracked walls and plaster.
78	1935	1/10	01:10	Grand Canyon, Arizona 36.1°N 112.2°W	VI	" "	Local. Windows broken and plaster cracked at Grand Canyon, Arizona. Minor rock slides.

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79	1935	12/5	14:25	Fredonia, Arizona		Abstracts	Compact level ground. Rapid southwest-northeast motion. Consisted of two shocks and the second lasted 5 seconds. Felt by many. Windows rattled; pianos shook for several seconds.
80	1936	1/12		Grand Canyon		" "	Noticeable earth tremor lasting for about 5 seconds with decided rumbling noise. Continued vibrations for about 10 seconds.
81	1936	2/24	Shortly before midnight	Kingman		S.N. v 26 n 3, p. 283	A slight earthquake. Telephone communication with Needles, Calif., broken.
82	1937	4/8	Early a.m.	Canado, Arizona		S.N. v 27 n 3, p. 255	It was reported by the press that an early morning earthquake did slight damage.
83	1937	12/17	16:30	Flagstaff, Arizona		Abstracts	Shock felt by several. Not felt by observer. One observer said roar came from northeast, another said there was more sound than vibration. Rattling of windows, doors, and dishes. Ground underneath rocky soil, compact.
84	1937	7/20	15:49	Seligman		" "	The residents of this district were disturbed by an earthquake which did little damage, but was of sufficient strength to be noticed by everyone in the community. The quake caused windows to rattle, pans to dance, and floors to weave. It was of several minutes duration and traveled in a north-south direction as far as could be determined. A second shorter quake was felt at 20:00. A rumbling sound accompanied each quake.
85	1937	7/21	16:55	Phoenix		" "	One short heavy thud, slight upward motion and then settling quiet. Felt by all, disturbed small objects. Sounded like a heavy charge of powder in soft ground, according to observer. Frightened no one. Small report about 20:00.

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86	1938	6/5	19:30	Yuma		Abstracts	Shock reported felt by several. Trembling motion, too slight to tell much about it, according to observer.
87	1938	9/17	10:20	Arizona- New Mexico border. 33.2°N, 108.6°W	VI	E.Q. Hist. of U.S. p. 52	Felt area 8,000 sq. mi. At Duncan, Arizona, bottles fell from shelves. Plaster and walls cracked slightly. Deep rumble heard by many in Clifton, Arizona. Affected area about evenly divided between New Mexico and Arizona.
88	1938	9/19	22:40	Arizona- New Mexico border	V	E.Q. Hist. of U.S. p. 52	Aftershocks of 9/17.
89	1938	9/24	08:25	Santa Rita, New Mexico		Abstracts	Motion rapid, lasting few seconds. Felt by observer. Rattling of windows, doors and dishes. Hanging objects did not swing. Awakened no one. One felt at Bonita, Arizona, 11:00.
90	1938	9/29	16:34	Arizona- New Mexico border	V	E.Q. Hist. of U.S. p. 52	Aftershocks of 9/17.
91	1938	9/31	23:25	Arizona- New Mexico border	V-VI	" "	Aftershocks of 9/17.
92	1939	2/19	04:00	Grand Canyon (11 mi. NE of)		Abstracts	Motion bumping, beginning gradual, lasting 2-4 seconds. Felt by several. Direction of motion felt outdoors north-south. Rumbling sounds accompanied shock. About 8 shocks from 4 a.m. to 4 p.m. noticed by numerous people. Most shocks seemed like heavy blasts, another shock at 4:35 p.m. 2/20/39, according to observer.



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93	1939	3/9	11:30	Grand Canyon (4 mi. NE of)		Abstracts	Motion bumping, with gradual onset. Felt by several. Direction of motion felt north-south. Rumbling subterranean sounds heard by several before shock. A severe shock occurred at junction of Pipe Creek and Colorado River, about 6:30 a.m., 3/9/39, according to observer. It shook dishes from racks, and awakened all occupants of a construction camp. This is four miles north of the post office at Grand Canyon, Arizona.
94	1939	5/4	13:44	Near Las Vegas, Nev. 36.0°N 114.8°W	VI	E.O. Hist. of U.S. p. 52	Felt area 7,000 sq. miles. Centered in sparsely inhabited area of Nevada and Arizona. Several towns reported minor damage. Maximum intensity reported was VI, but may have been higher at epicenter. Large rocks were loosened and nearly blocked roads at a few points near Hoover Dam. A large dust cloud was seen to the south of Boulder City, probably caused by earth slides.
95	1939	6/3	18:15	Duncan, Arizona		Abstracts	Beginning abrupt, lasting about five seconds. Felt by many. Rattling of windows, doors, and dishes. Cracked plaster. Felt by some outdoors.
96	1939	6/3	22:00	Clifton, Arizona		" "	Motion rapid, beginning abrupt, lasting one minute. Felt by some outdoors. Rattling of windows, doors, and dishes, creaking of walls. Hanging objects did swing; moved small objects. Awakened few; frightened no one. No damage. Ground underneath sloping and rocky.
97	1939	6/11	12:15	Duncan, Arizona		" "	Motion slow. Felt by few. Rattling of windows, doors, and dishes. Awakened no one. Ground underneath compact.

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98	1940	10/16	06:25	Flagstaff (3 mi. N of)		Abstracts	
99	1941	5/21	09:25	Willow Beach, Arizona		" "	Motion rapid, beginning abrupt, lasting 2 seconds. Jar so sudden it stopped motion of hammock. Felt by some outdoors, direction North-South. Rattled dishes. Moved small objects. Ground rocky.
100	1942	10/21	08:22	S. Calif. 33.0°N 116.0°W	VII Mag. 6½	E.Q. Hist. of U.S. p. 52	Felt area 35,000 miles. Felt in Western Arizona.
101	1944	1/30	22:24: 58	Fredonia, Arizona 36.9°N 112.4°W	IV	Abstracts	Motion rapid, beginning abrupt, lasting 3 seconds. Felt by many. Direction SW. Level soil. Rattled windows, doors; hanging objects swung. Frightened few.
102	1945	7/?	05:55	Grand Canyon	IV	" "	Motion rapid. Felt by many in community. Ground rocky. Awakened few in community. Rattled windows, doors. "Reported by several people to the park naturalist. Described as a grind- ing and rumbling, plus trembor. Reported as far south as Williams, Arizona." (This appears to refer to the arrival of air waves from the atomic bomb test on 7/16 in New Mexico Seismological Labor- atory, Pasadena.)
103	1947	4/10	07:58 PST	(felt at) Phoenix Epicenter: 35°N 116.6°W 125 mi NE L.A.	Mag. 6.4	S.N. v. 37 n.2, p. 162	A destructive earthquake, felt from Santa Barbara to San Diego on the California coast, as far north as Porterville in the San Joaquin Valley, and as far east as Phoenix and Las Vegas, caused considerable damage in the small San Bernardino Co. settlements of Newberry, Yermo, and Field in the Mohave Desert near the epicenter. Two distinct shocks were recorded

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
104	1947	5/18	21:43	Kingman, Arizona		Abstracts	at Pasadena, at 7:58:32 a.m., and 8:03:27 a.m. PST. It was one of the few earthquakes ever felt at Phoenix and was strong enough to sway structures there. In Las Vegas, the shock interrupted gambling devices and knocked a coffee pot off a stove. The U.S. Coast and Geodetic Survey reports an earthquake at 15058m04s, G.C.T. with provisional epicenter 35.0°N, 116.6°W, 126 miles NE of Los Angeles.
105	1947	11/26	21:16	N. Arizona	IV	" "	Shock reported felt. (No details)  Recorded at Pasadena, California, Seismological Lab. (Wupatki National Park Service). At 8:55 p.m. on 10/26, a prolonged peal of thunder was heard by the observer and his wife. The night was cloudless and there was no static on the radio. No observation was made other than to go outside to see if a storm was approaching. At 9:14 p.m., another prolonged peal of thunder (about 45 seconds) was heard. Went outside again and upon returning several minutes later found a suspended vase swinging in E W direction. An employee was aroused by the rattling of dishes.
106	1948	1/23	19:57	Inner Canyon, Arizona		" "	Shock felt at Inner Canyon and Tuba City, Cottonwood, and on the south rim. No details.
107	1948	1/25		" "		" "	Shock felt. No details.
108	1948	12/3	11:45	Winslow, Arizona	IV	" "	Abrupt onset. Felt by many. Loose objects rattled; building creaked and shook as if chimney had fallen on roof. One unverified report of broken plaster. Subterranean sounds like a distant explosion heard at time of shock. Ground: Adobe. Motion bumping on rocky ground.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
109	1949	11/1	19:30	Tuweep, Arizona	V	Abstracts	North section of Tuweep Valley, Mohave County. Motion swaying, N → S, abrupt onset. Felt by several. Small landslides from cliffs on eastern side of valley. Buildings creaked; loose objects rattled. Disturbed objects observed by several. Visible swaying of buildings and trees. Hanging objects swung. Few alarmed. First shock ever felt by most people.
110	1950	1/16	17:53	Apache Co., Arizona 35.5°N 109.5°W	VI	E.-Q. Hist. of U.S. p. 52	Ground cracks one-half inch wide and twelve feet long in Ganado. Rumbling sounds heard. Rattled windows and dishes. Felt by one-half the people questioned.
111	1950	2/2	03:37	S. Ariz. 32.0°N 113.0°W		S.N., v 40 n. 2, p. 157	The survey reports an earthquake with preliminary epicenter 32°N, 113°W. This location is in the Organ Pipe Cactus National Monument in S. Arizona, close to the Mexican boundary.
112	1950	7/29	07:37	Imperial Valley, felt Calif., felt in Yuma, Ariz.		S.N., v. 40 n 4, p. 313	Beginning at 2:40 a.m. PDT, on 7/27 the Imperial Valley felt a series of earthquakes that lasted for more than a week. The strongest shock occurred on 7/29 at 7:37 a.m., and was felt as far east as Yuma, Arizona, and Parker Dam, and as far west as Tecate, Baja, California.
113	1950	7/29	06:36: 32	Calipatria, California, 33.07°N 115.34°W	VIII	Roberts & Ulrich	Felt over much of W. Arizona. Felt area of 18,500 sq. mi.
114	1951	1/23	23:17: 01	"	VII Mag. 5.6	"	Felt in Yuma and far W. Arizona: Yuma, Parker Tacna. Felt area 14,000 sq. mi. Intensity V in Arizona.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
115	1951	1/24	01:38: 23	Calipatria, California 33.07°N 115.54°W	IV	Abstracts	Felt in Yuma (Intensity III). Felt by several. Motion rolling S N. Ground: sandy.
116	1951	3/5	16:00	Fredonia	IV	" "	Abrupt onset, lasted about 3 sec. Felt by several. Rattled windows, doors, and stove pipe. Ground: soil, level.
117	1951	4/11	23:20: 16	Ariz-Mex. border	4½	S.N. v. 41 n 3, p. 247	The survey reports an earthquake with preliminary epicenter 32°N, 113°W. Pasadena estimates the magnitude as 4½. This location is in the Organ Pipe National Monu- ment, Arizona.
118	1952	5/23	21:15	Ariz-Nev. border 36.1°N 114.7°W	VI	Roberts & Cloud	Plaster cracked at Boulder City and Whitney, Nevada.
119	1952	7/21	04:52: 14	Bakersfield, Calif. Felt in W. Ariz. 35.00°N 119.02°W W, Wheeler Ridge, Cal.	I to IV in Arizona. VIII to XI in Bakersfield area. 7.7 Mag.	" "	An engineering study of the Southern California earthquake of 7/21/52 and its aftershocks. Largest earthquake in the U.S. since 1906. Estimated damage \$60,000,000. Felt in W. Arizona.
120	1952	10/22	12:46: 36	Sierra del Pinnacle, Sonora, Mexico 32°N, 113½°W		S.N. v. 43 n 1, p. 91	Arizona-Mexico border region. The Survey reports an earthquake with an epicenter at 32°N, 113½°W. The earthquake was felt in Tucson.
121	1953	6/13	21:19	Imperial Valley, Cal. 33°N 115-3/4°W	5.4 to 6	S.N. v. 43 n 4, p. 377	Felt in Phoenix.
122	1953	6/13	21:17: 28	Brawley, Calif. 32.8°N 115.7°W	VII in Brawley I-IV in Ariz.	" "	Felt in W. Arizona. Felt area 4,800.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
123	1954	3/19	01:54	Cal-Az. 33.5°N 116.2°W	Mag. 6.2 VI	E.Q. Hist. of U.S. p. 53	This southern California earth-quake cracked concrete on two bridges at Topock, Arizona. Felt area 40,000 sq. miles.
124	1954	7/6	03:13	Nevada 39.4°N 118.5°W	IX, 6.6	"	Felt area 130,000 sq. mi. A series of destructive shocks centering in W. Nevada were widely felt in the W. U.S., including Arizona, Idaho, and Utah.
125	1954	8/23	21:52	Nevada 39.4°N 118.5°W	6.8, IX	E.Q. Hist. of U.S. p. 53	Felt area 150,000 sq. mi.
126	1954	12/16	03:07	"	7.1, X	"	Felt area 200,000 sq. mi.
127	1955	12/17	23:07: 27	Felt in Yuma, center near Brawley 33°N, 115.0°W	5 1/4 to 5 1/2	S.N., v. 46 n 2, p. 150	Strongest of series of 82 shocks in the Brawley, Calif., area. Damage was concentrated at Brawley where twelve water mains were broken, street lights and about 20 plate glass windows were shattered, merchandise was hurled from shelves and walls of houses and other structures were cracked.
128	1956	2/9	07:33	In Mexico or lower Calif. Felt in Tucson 31.8°N, 115.9°W	6.8 Richter Mag. n. 2, p. 160 Pasadena: VI	S.N., v. 46 n. 2, p. 160	This main shock of a series caused minor damage in southern Calif. orria and was felt at Yuma, Ariz. Two aftershocks on 2/14 shook a large area of Calif. and Arizona. Felt area 30,000 sq. mi.
129	1957	4/25	13:58	Calif. 33.2°N 115.9°W	VII Mag. 5.2	E.Q. Hist. of U.S. p. 68	Felt area 12,000 sq. miles. Felt in W. Arizona.
130	1958	12/1	20:21: 17	Mex-Cal. border 32.2°N, 115.8°W	5.7 Pasadena	S.N., v. 40 n. 2, p. 206	Felt throughout southern Calif. and western Arizona. Several strong aftershocks.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
131	1959	2/11	7 a.m.	Flagstaff 32.2°N 111.7°W	V	S.N., v. 49 n. 3, p. 286	Three tremors shook Flagstaff. No injuries or damage were reported.
132	1959	7/21	10:39: 29	Flagstaff 37.0°N 112.3°W	5½ - 5-¾/4 Pasadena	S.N., v. 50 n. 2, p. 158	The earthquake knocked dishes and canned goods to floors, started minor rock slides, and awayed automobiles on the streets over a wide area of southern Utah and northern Arizona. Bricks fell from one chimney and plaster was shaken from the country court-house in Kanab, Utah. There were no reported injuries. The shock was felt as far south as Flagstaff, Arizona.
133	1959	10/13	01:15	Flagstaff 35.3°N 111.3°W	V	S.N., v. 50 n. 2, p. 161, E.Q. Hist. of U.S.	Felt at Flagstaff. Felt by many and awakened many. Buildings creaked; windows, doors, and dishes rattled.
134	1961	2/11	20:51	Mex.-Ariz. border 31.0°N 109.1°W	IV	E.Q. Hist. of U.S. 1961, p. 11	Felt by many at Bisbee, where buildings creaked; loose objects rattled. Three shocks with rapid onset; trembling motion in north-south direction. Felt by two at Douglas.
135	1962	2/15	00:13 by E.Q. Hist. of U.S.	36.9°N 112.4°W focal depth of U.S., 26 km	V	S.N., v. 52 n. 4, p. 698 & E.Q. Hist. of U.S.	Awakened all and frightened few at Kanab; many awakened, few frightened at Orderville. Also felt at Rockwell. No damage. Focal depth 26 km.
136	1963	9/11	05:00	Ariz-Utah border 33.2°N 110.7°W	4.1	S.N., v. 54 n. 2	Felt: Miami, Globe, San Carlos, and Superior. Felt over 2,500 sq. mi. Slight damage reported at Globe, San Carlos and Ray. Focal depth, 33km.

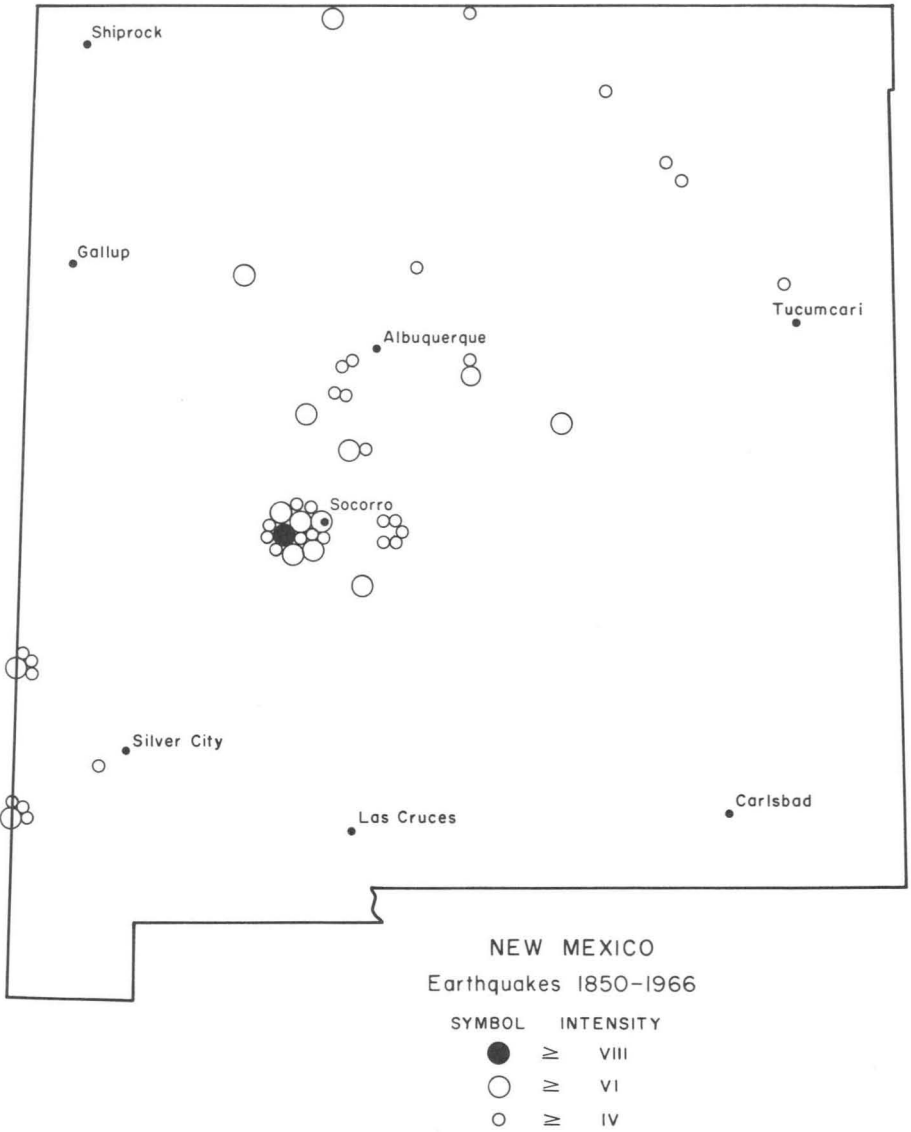


Figure 3.--Location Map of Earthquake Epicenters in the State of New Mexico for the Period 1850-1966.



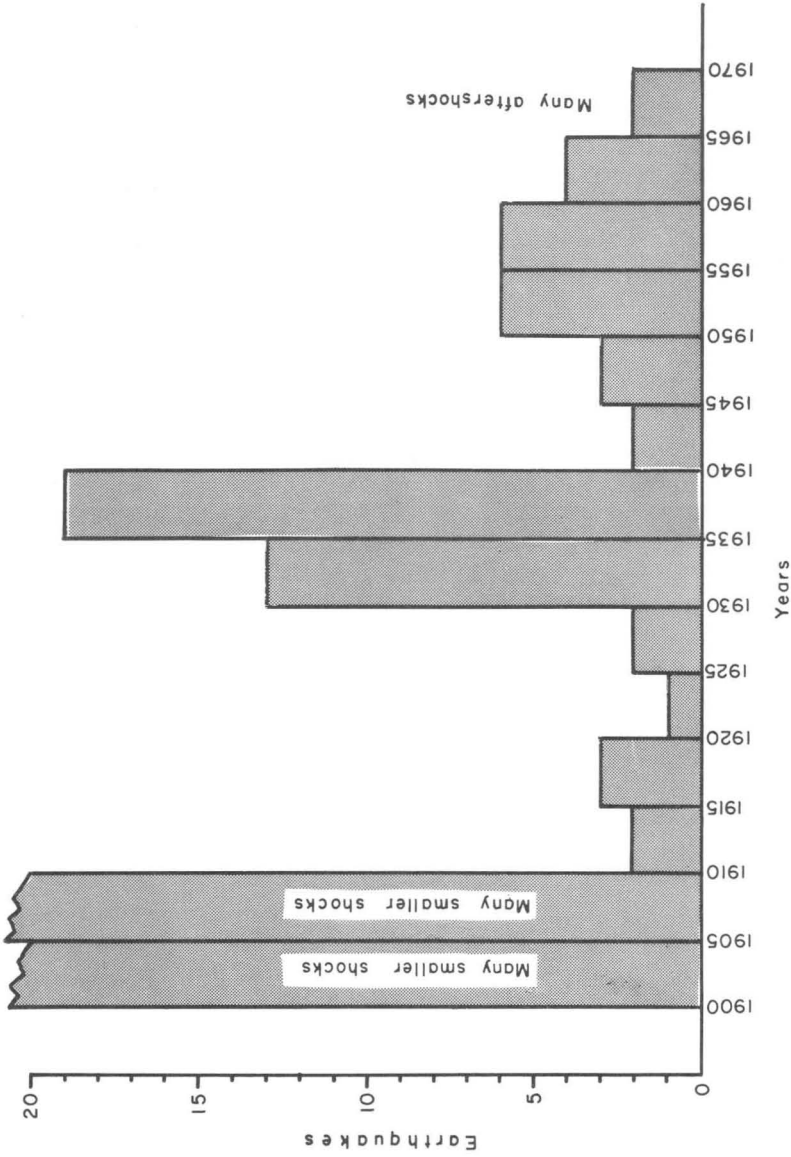


Figure 4.--Bar Graph Illustrating Yearly Record of Earthquakes with Epicenters Proven or Thought to be in New Mexico for the Period 1900-1966.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
1	1868	4/28		Socorro, N.M. 34.0°N 107.0°W	V	E.Q. Hist. of the U.S.	
2	1869			Socorro, N.M. 34.0°N 107.0°W	VII	E.Q. Hist. of the U.S.	Springs changed flow and became muddy.
3	1879			" "	V	" "	
4	1886	7/6		" "	" "	" "	
5	1887	5/3	14:13	Sonora, Mex. 31°N 109°W	VIII-IX	" "	Much destruction in Bavispe, Mexico. Houses and church destroyed, at places as far away as Albuquerque, water in tanks slopped over, cars were set in motion on the tracks, chimneys were thrown down, buildings cracked. Millions of cubic feet of rock were thrown from mountains. Cliffs of solid crystalline rock were shattered as if by explosion. One narrow canyon contained an immense amount of material from adjacent cliffs. Seismic movements were felt from Toluca, Mex. near Mexico City, to Albuquerque and Santa Fe, New Mexico, on the north, from Guaymas, Mexico, and Yuma, Arizona, on the east. The central tract of maximum intensity was found in the San Bernardino Valley and the neighboring part of the Texas Mountains.
6	1893	7/12	06:07	Albuquerque, NM 35.0°N 106.4°W	V	E.Q. Hist. of the U.S.	Three shocks shook every house in city. Clocks stopped. A chandelier swung for 10 minutes.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
7	1893	9/7		New Mexico 34.7°N 106.6°W	VII	E.Q. Hist. of the U.S.	Central New Mexico was subjected to shocks for 3 months during this period, the most severe being on September 7. Five shocks threw down many adobe buildings at Los Lunas, which were already weakened by previous earthquakes. No lives were lost, but many suffered from nausea. Also felt at Sabalinal.
8	1895	10/7		34.5°N 106.7°W	V	"	Articles thrown from shelves. Felt at Albuquerque.
9	1895	10/31	05:00	Socorro, NM 34.0°N 107.0°W	VI	"	
10	1897			Socorro, NM 34.0°N 107.0°W	VI	"	Waves seen in ground.
11	1904	1/9		"	V	"	During this period (1/19 to 9/10) five shocks of intensity V-VI were reported. In addition, many smaller shocks were observed, 34 in first 3 months of 1904.
12	1904	9/10		"	VI	"	Felt 40,000 square miles. Some damage. Lasted 15 to 20 seconds.
13	1906	7/12	05:15	"	VII-VIII	Reid, H.F.	Walls cracked, chimneys thrown down.
14	1906	7/16	12:00	"	VIII	Reid, H.F.	Felt 100,000 square miles. Upset many chimneys. Many of the people of Socorro left their houses and lived in tents from fear of more shocks which might bring their houses down upon them. The Socorro Hotel, a brick building in the eastern part of town, was abandoned on account of the injuries it sustained and the majority of the houses of the town suffered some damage. The southeast corner of

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
15	1906	11/15	05:15	Socorro, NM 34.0°N 107.0°W	VII-VIII	Reid, H.F.	the brick post office was thrown out and its eastern wall bulged; the court house and the high school lost several chimneys, but the school of mines building, about a mile from Socorro, was not damaged.
							Felt 100,000 square miles. Between 6-2-06 until well into 1907, scarcely a day passed that slight shocks or tremors were not felt at Socorro, NM, and its vicinity, and shocks severe enough to do some damage occurred on 6/12, 6/16 and 11/15. The severest shock of the year occurred on 11/15 at throughout Cent., NM. It increased the damage already done in Socorro, but was not much more severe than those of 6/12 and 6/16.
16	1910	9/23	21:05	N.E. Ariz. 36°N 111.1°W	VIII	E.Q. Hist. of the U.S.	Felt over 45,000 square miles in northwestern New Mexico, Utah, and Arizona. Fifty-two quakes were felt in this area between 9/10 and 9/23/10.
17	1912	8/18	14:12	Arizona 36.5°N 111.5°W	VI-VII	"	Felt over 55,000 square miles in New Mexico, Utah, and Arizona.
18	1913	7/18		Socorro, NM	VII-VIII	"	Strong shock.
19	1913	12/5	17:15	Arizona & NM 34.1°N 106.8°W	"	"	Felt throughout Arizona and New Mexico.
20	1918	5/28	04:30	New Mexico 35.5°N 106.6°W	VII-VIII	"	Felt over 7,500 square miles. Santa Fe City, New Mexico. Intensity VIII reported from Cerillos. At that place plaster fell, people were thrown off their feet, and there was a break in the earth's surface at the edge of

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
21	1919	1/31	21:30	Socorro, NM	IV-V	E.O. Hist. of the U.S.	town. A rapid twisting effect was noted at several places. There was sound like distant thunder. At Stanley, doors rattled, a piano sounded, walls and plaster cracked. People were thrown down. The shock was apparently quite local with force fading rapidly with distance from epicenter.
22	1919	2/1	13:30	Socorro, NM 34.0 <sup>0</sup> N 107.0 <sup>0</sup> W	V	" "	
23	1924	8/12	21:23	New Mexico 36.0 <sup>0</sup> N 104.5 <sup>0</sup> W	V	" "	Strongest at Abbot and Roy, in Northeast New Mexico.
24	1930	3/23		Albuquerque, New Mexico		S.N., vol. 20 p. 58, no. 1	Dishes and furniture rattled, but no damage was done by the shock.
25	1930	12/3	14:36	Albuquerque, New Mexico 35.0 <sup>0</sup> N 106.0 <sup>0</sup> W	V-VI	E.O. Hist. of the U.S. S.N., vol. 21 no. 1, p. 64.	Two earth tremors were felt. Buildings throughout the city were shaken. It was reported that telephones were knocked off desks in one building.
26	1931	2/4	21:48 or 21:36	Albuquerque, New Mexico 35.0 <sup>0</sup> N 106.0 <sup>0</sup> W	VI	E.O. Hist. of the U.S. and S.N., v. 21, n. 1, p. 78	A sharp earth tremor lasted about 30 seconds. Caused people to leave houses and near panic in theaters. Some buildings damaged and landslides.
27	1934	1/7	18:32	Socorro, NM 34.0 <sup>0</sup> N 107.0 <sup>0</sup> W	V	S.N., v. 24 n. 1, p. 77	Local. Duration 3 or 4 seconds. No damage was done.
28	1934	5/6	22:22	Silver City, New Mexico 32.7 <sup>0</sup> N 108.2 <sup>0</sup> W	V	Abstracts	Considerable excitement and slight damage to adobe buildings. Felt area 200 square miles. Furniture moved, picture fell from a wall.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
29	1934	5/7	18:15 21:00	Socorro & Magdalena, New Mexico	III	Abstracts	An earthquake lasting 6 seconds, shook buildings and jarred doors and windows. Movement was from north to south.
30	1935	1/17	07:35	Socorro	III	S.N., v. 26 n. 1, Abs.	Two distinct earthquakes were felt.
31	1935	1/19	19:25	Socorro	IV	Abstracts	Vertical trembling motion; felt by many; small objects and furnishings rattled, cans in barrel rattled; similar to preceding quake, but stronger.
32	1935	2/20	18:25 20:05	Bernardo, NM 34.5 <sup>N</sup> 106.8 <sup>W</sup>	VI	E.Q. Hist. of the U.S.	Sandy loam; southeast trembling motion began gradually; felt by few; loose objects and furniture rattled, coping cracked on building, walls and plaster cracked, adobe and concrete buildings partially damaged; accompanied by thunderous roar. Felt in Lajoya, NM (2 quakes).
33	1935	12/12	Night	Belen, NM		Abstracts	Weak.
34	1935	12/14	Evening	Los Lunas, NM		Abstracts	Slight.
35	1935	12/17	22:33	Belen, NM 34.8 <sup>N</sup> 106.8 <sup>W</sup>	V-VI	E.Q. Hist. of the U.S. S.N., v. 26 n. 1, p. 93	Felt over 2,000 square miles. A heavy shock resulted in the closing of school. Adobe valley felt by many, some alarmed. Moderately loud subterranean sounds; bumping motion. Building cracked and loose objects rattled as if a truck had hit buildings. Brick wall of school cracked.
36	1935	12/18 12/30	Var.	Belen, NM 34.8 <sup>N</sup> 106.8 <sup>W</sup>	V-VI	E.Q. Hist. of the U.S. S.N., v. 26 n. 1, p. 93	After one of the more severe shocks, a crack, one inch wide and several feet long showed in the walls of a brick building. Many individual tremors.

NO.	YEAR	DAY	HOURLY	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
37	1936	1/7	11:44	Carlsbad, New Mexico		S.N., v. 26 n. 2, p. 178	"Mr. W. B. Lang, of the U.S. Geological Survey, reported that he felt an earthquake in Carlsbad, and that it had a possible duration of 3 seconds and a north-south motion. Press reports also state that an earthquake was felt in Southern New Mexico, which caused some property damage.
38	1936	9/9	05:55 05:57	Albuquerque, New Mexico		S.N., v. 26 n. 4, p. 394	Two slight shocks were felt. Windows and dishes rattled and sleepers were awakened. No damage was reported.
39	1938	9/17	10:20	Ariz-NM border 35.2°N 108.6°W	VI	E.O. Hist. of the U.S.	Felt over 8,000 square miles.
40	1938	9/19	22:40	" "	V	" "	Local.
41	1938	9/29	16:34	" "	V	" "	"
42	1938	10/31	23:25	" "	V-VI	" "	"
43	1938	11/2	02:00	Silver City, New Mexico		S.N., v. 29 n. 2, p. 413	The third earth shock in forty-eight hours was felt. It was said to have lasted as long as 15 seconds in the Pinos Altos Mountains.
44	1939	1/18	07:00	Cliff, NM		Abstracts	Weak.
45	1939	1/20	05:10	Gila & Vicinity, New Mexico		" "	Motion rapid, beginning abrupt, lasting about two seconds. Felt by several. Direction of motion felt north. Rattling of windows, doors, and dishes. No damage - ground underneath sloping, rocky.
46	1939	1/31	10:10 10:15	Hillsboro, New Mexico		" "	Motion rapid, beginning abrupt, with a five minute interval. Felt by many. Felt by some outdoors. Rattling of windows, doors and dishes. No damage - ground underneath sloping and rocky.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
47	1939	4/25	10:16	Cliff, NM		Abstracts	White Creek Ranger Station. Motion rapid, beginning abrupt, lasting 2 seconds. Felt by few. Direction of motion felt east. No damage. Ground underneath level, loose, rocky soil.
48	1939	4/25	18:57	Cliff, NM		Abstracts	White Creek Ranger Station. Description same as quake, at 10:16 of this day.
49	1939	5/5	14:57	Cliff, NM		Abstracts	White Creek Ranger Station. Motion rapid, beginning abrupt, lasting one minute. Felt by several. Felt outdoors by observer. Direction of motion felt east. Rattling of windows; creaking of walls. Hanging objects did not swing. Frightened no one. No damage. Two more quakes were felt at 15:05 and 15:30.
50	1939	5/10	01:00	Cliff, NM		Abstracts	White Creek Ranger Station. Shock lasted one second. Felt by few. No damage.
51	1939	5/21	14:00	Cliff, NM		Abstracts	White Creek Ranger Station. Motion rapid, beginning abrupt, lasting one second. Felt by several. Direction of motion felt west. No damage.
52	1939	5/21	17:00	Cliff, NM		Abstracts	White Creek Ranger Station. Motion rapid, beginning abrupt, lasting one minute. Felt by several. Direction of motion felt west. Rattling of windows, doors and dishes; creaking of walls. Hanging objects and doors did swing. Frightened no one. No damage.



NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
53	1929	5/23	08:25	Cliff, NM		Abstracts	White Creek Ranger Station. Motion rapid, beginning abrupt, lasting one minute. Felt by few. Direction of motion felt west. Rattling of windows and doors; cracking of walls and frame. Frightened no one and no damage.
54	1939	7/22	P.M.	Mogollan, NM		Abstracts	One shock motion trembling, with gradual onset, lasting 3 seconds. Felt by several. Direction of motion from west. Distinct, roaring rumbling heard before and up to time of shock. One-quarter inch crack in concrete retaining wall was observed.
55	1939	7/28	17:05	Mogallan, NM		Abstracts	One shock, motion trembling, with gradual onset, lasting five seconds. Felt by several. Direction of motion felt from west. Rattling of windows, doors, and dishes; creaking of walls and frame. Distinct, roaring rumbling heard before and up to time of shock. Frequent occurrence; frightened no one, according to observer. Ground underneath rocky.
56	1941	8/4	00:40	Socorro		S.N., V. 31 n. 4, p. 350	An earthquake which rattled dishes and shook furniture was felt. No damage was reported. Several persons awakened, few alarmed, ran from homes. Some plaster fell.
57	1942	12/27	21:45	Magdalena, NM	IV	Abstracts	Motion bumping, abrupt onset. Felt by many. Rattled doors and windows.
58	1947	11/6	09:50	Northeastern Bernalillo County, NM (Sandia Mt. Region, Texas) 34°N, 102½°W	VI	E.Q. Hist. of the U.S.	Felt by all at Zamora where plaster and fireplace cracked and south wall of house was damaged. Intensity V at San Antonio, Sandia Park and near Cedar Crest.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
59	1948	3/11	22:29	Delbert - Amarillo region of Texas, 36°N 102½°W	VI	Seismological Act. of the U.S. Coast & Geodetic Sur- vey in 1948 Roberts, E.B. & Ulrich, F.P.	Epicenter in Texas, felt in New Mexico, Oklahoma, Kansas, and Colorado. Over 50,000 square miles. Very slight damage mainly cracked plaster.
60	1949	2/2	17:00	Carlsbad, NM	IV	Abstracts	Motion rapid, lasted a few seconds. Felt in several homes; frightened few people. Rattled windows, doors, dishes; house creaked.
61	1949	5/23	00:22	East Vaughn, NM, 34.6°N 105.2°W	VI	E.Q. Hist. of the U.S., page 52	Motion bumping or jerking, abrupt onset. Felt by many; awakened many. Loose objects rattled; buildings creaked. Deep rumbling and grinding subterranean sounds before and during shock.
62	1951	6/20	11:37	Texas-NM Border		S.N., v. 41 n. 4, p. 392	The Survey reports an earthquake with preliminary epicenter 35½°N, 105°W. The earthquake was reported felt. This location is in northwest Texas, near the N.M. border, north and west of Amarillo.
63	1952	8/3	20:42	Cimarron, NM	V	E.Q. Hist. of U.S. and Abstracts	The press reported a jolting earthquake of duration, was felt by most residents. Houses shook and objects rattled. Sounded like a door slammed or a car hit the house. Ground rocky and soil. Motion lasted 30 seconds.
64	1952	8/17	03:45	Los Alamos, N.M., 35.5°N, 106.2°W	V	" "	Felt by, awakened, and frightened all in home. Slight damage to walls reported. Bassinet shifted; doors and dishes rattled.
65	1952	9/7	02:20	Colorado-New Mexico border region, 37.0°N 106.0°W	V	" "	Reported felt over a small area of the border regions of S. Colorado and N. New Mexico. Rocks and boulders dislodged at Antonito, Colorado. Awakened many and shifted small objects at Chama and Tres Piedras, N.M. Felt strongly at Osier, Cl.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
66	1954	11/3	13:29	Albuquerque, New Mexico 35.1°N 106.7°W	V	E.Q. Hist. of the U.S.	Minor plaster cracks reported. Also felt at Bernalillo, Sandoval, and Sandia Pueblo. A smaller shock on 11/2 at 10:00 felt over same area.
67	1955	8/12	09:20	Santa Fe, New Mexico 30.2°N 104.6°W	V	"	A minor earthquake rattled windows. There were no reported injuries or damage.
68	1960	7/22	08:49	La Joya, NM 34.0°N 106.3°W	V	E.Q. Hist. of the U.S., 1960, p. 16	Trophies fell from shelves in high school. Felt at Socorro, Bernardo and San Acacia.
69	1960	7/23	07:15	"	V-VI	"	Felt over 3,000 square miles, Belen to Socorro. At Bernardo, people ran outdoors, and canned goods fell from shelves.
70	1960	7/24	03:37	San Bernardo, NM, 24.0°N, 106.5°W	V	"	Local. Two small windows broken. Awakened many.
71	1960	9/25	12:20	Socorro, NM	III	E.Q. Hist. of the U.S., 1960	Felt by several. Single jolt of house. Also felt at 3 and 7 miles south of Socorro.
72	1960	12/19	16:29	"	IV	"	Felt by many, windows rattled. The New Mexico Institute of Mining and Technology seismographic station reported the shock was centered about 4½ miles southwest of Socorro.
73	1961	1/27	23:33	Socorro, NM	IV	E.Q. Hist. of the U.S., 1961	Felt by many in community; awak- ened few. Windows, doors, and dishes rattled. Rapid motion, moderate earth noises heard.
74	1961	7/3	00:06	Central N.M. 33.6°N 106.9°W	VI	"	Felt by many and awakened many in community; frightened few. Damage slight. Plaster cracked in adobe buildings. Rapid 3-5 sec. motion, moderate to loud earth noises from west.

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
75	1965	2/3	04:33	Northeastern New Mexico	IV	E.Q. Hist. of the U.S., 1965, p. 13	Shock felt at Logan, Nera Visa, and in the Gallegos area (about 50 miles north of Tucumcari). Windows and doors rattled; frame cracked. Motion slow, two shakes of one second duration.
76	1965	12/21	20:33 21:04	Socorro, NM 34.09°N 106.57°W	IV	E.Q. Hist. of the U.S., 1961, p. 18	Two shocks. Windows rattled at Socorro. The intensity was similar to that of a sonic boom. Also felt at Escondida, Lemitar, and Polvadera.
77	1965	12/22	03:33 04:04	"	IV	S.N., v. 56 n. 3, p. 784	
78	1966	1/23	01:56	37.0°N 106.9°W	VII	S.N., v. 56 p. 796	Focal depth 10 km. "At Dulce (north Rio Arriba County), where it was reported many houses and buildings were damaged. Porches were displaced from houses; walls and foundations cracked; water pipes broken, fireplaces cracked in half; church roof partially collapsed; 20 by 30 feet glass window broken. Rock and earth were shaken loose from Dulce Rock, a promontory about 300 feet high, near the community. People in house were knocked down. At Lumberton, about 4 miles east of Dulce, plaster fell off church roof and a 6-foot crucifix was broken. In Colorado a farmer living near Edith, about 10 miles northeast of Dulce, reported a stove was moved 8 inches, walls cracked and dishes broken. At Pagosa Springs, objects fell from shelves. Reports indicated the shock was felt over a wide area. In New Mexico, 70 miles west of Dulce to Farmington, about 30 miles southeast of Dulce, and at Durango, about 65 miles northwest of Dulce. Many aftershocks were

NO.	YEAR	DAY	HOUR	LOCATION	MAGNITUDE/ INTENSITY	REFERENCE	REMARKS
79	1966	5/19	00:27	37.0°N 107.2°W Focal depth 5 km	4.6 CGS	S.N., v. 56 n. 6	<p>were felt. One observer at Dulce reported, "Since the initial tremor, many more shocks have occurred, but always of a less pronounced nature. My recollection is that at least 40 very slight tremors followed during the ensuing 5 days and no confirmation made of termination at this time. (1/27). (W. K. Cloud, S. F. Field Office.) Nearly every house in Dulce affected. Damaged estimated at \$200,000. Between 1/23 and 1/28, 119 events were recorded at the Albuquerque Observatory, a distance of about 225 km from Dulce. Three temporary seismic stations were installed by the USCGS on 1/28 near the Dulce area. During their first week of operation, 218 events were recorded by these stations. All of the aftershocks are located in a small area close to the town of Dulce. (John Hoffman, CGS, Albuquerque, Personal Communication). Thirty-four aftershocks were published on the Preliminary Determination of Epicenter Cards."</p> <p>Aftershock of the January 20, 1966, Dulce earthquake.</p>