



Earthquakes of central New Mexico

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EARTHQUAKES OF CENTRAL NEW MEXICO

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After experiencing several earthquakes in Albuquerque in 1930 and 1931, and especially the Belen swarm of 1935-36, I became interested and in 1941, as State Collaborator for New Mexico, Seismological Field Survey, U. S. Coast and Geodetic Survey, I began to participate in gathering noninstrumental information by the questionnaire-card method. (New Mexico did not have a seismological station until 1959.)

A study of available information, chiefly old newspaper files, shows that more than 600 earthquakes have been definitely felt in New Mexico between 1855 and the present. For several years it was thought that the earliest quake was one in 1868, but the diary of a soldier stationed at Socorro refers to one there in 1855 (apparently the earliest in the Rocky Mountain region except for one recorded in Montana by the Lewis and Clark expedition in 1805).

About 95 percent of the State's quakes have originated in a narrow belt along the Rio Grande depression between Socorro and Albuquerque; the majority of these have been concentrated in the southern part of the belt between Belen and Socorro. Shocks have been felt in the Socorro-Albuquerque belt in at least 30 different years from 1855 to the present. About half of the 600 shocks were recorded vaguely, the other half more definitely. There have been several of intensity VII to VIII on the Rossi-Forel scale. This scale, ranging from I (least) to X (greatest), has been replaced in this country by the Modified Mercalli Intensity (Damage) Scale of 1931,¹ which ranges from I (least) to XII (greatest).

Notable features of the Rio Grande earthquakes include: (1) occurrence in swarms (daily for 3 weeks in 1935, almost daily for 3 months in 1893, almost daily for 6 months in 1906); (2) maximum nocturnal frequency (more people notice them while in bed); (3) maximum annual frequency (82 percent) in the July-December period; (4) numerous strong to moderately strong shocks; (5) generally small areas affected by most of the shocks although a few extended beyond the State's borders; and (6) occasional property damage, but no loss of life.

In connection with items 2 and 3, it may be noted that, according to Davison's hypothesis, in continental interiors there is a nocturnal maximum along with a winter maximum and shocks tend to be of moderate intensity, whereas along continental borders there is a day-time maximum along with a summer maximum and shocks are often of destructive intensity. Along the Rio Grande the maximum monthly frequency is in July, but December ranks second, and September, third.

It is interesting, but perhaps not significant, that our maximum seismicity in July coincides with maximum precipi-

itation. Furthermore, the maximum seismicity of the last six months of the year coincides with maximum precipitation during these same months (amounting to about two-thirds of the annual amount at Socorro). A further curious fact is that the 1906 swarm of quakes was preceded in 1905 by the heaviest annual precipitation (22 inches) recorded in half a century for Socorro. I am not much impressed by these coincidences, for, as G. K. Gilbert astutely remarked long ago, many attempts at working out the periodicity of earthquakes are apparently successful because the great frequency of earthquakes on this planet furnishes examples for almost any time-system postulated.

Many of our shocks have been felt over small areas, ranging from less than 3,000 to about 7,000 square miles. Some have been felt over much larger areas. For example, one shock of the 1906 series was felt over an area of 75,000 square miles; another, over 95,000 square miles; and one over 180,000 square miles—from Raton, New Mexico, to El Paso, Texas, and Douglas, Arizona.

Property damage has occasionally been fairly heavy. Practically all the towns, villages, and farms are located on the floodplain of the Rio Grande and alluvium enhances the amplitude of motion. Also, the widespread use of adobe-brick construction accounts for much of the damage to buildings. An adobe building, of course, like one of brick, tile, or block, does not have the resilience of, and is not as earthquake-resistive as, a wood-frame or reinforced concrete building.

In the past, a number of explanations for the Rio Grande quakes have been offered by laymen, journalists, mining engineers, mathematicians, and even a few geologists. The quakes have been attributed to landslides in the mountains to the east or west of the valley; to faulting of bedrock in these mountains; to volcanic activity (fears have been expressed on several occasions that volcanoes near Socorro and those near Albuquerque might come to life and start spouting lava again). In 1906 the opinion was held by some that the Socorro series was caused by the San Francisco quake. And in 1931 a journalist thought one of the Albuquerque quakes was "the tail end of a shock" registered by instruments and known to have originated several thousand miles away in the Pacific. Apparently, no one ever considered the possibility that some of the earthquakes might be originating in the Rio Grande valley itself, that is, beneath the floodplain. Slow drifting, perhaps laterally in the bedrock beneath the valley fill at depths of several miles, may be in progress; occasionally a slight slip along a fault may occur, followed by elastic rebound to a position of no strain.

Earthquakes have been felt in Albuquerque on at least 26 different days in 11 different years from 1893 to 1956. Some of these originated near Socorro; some were near Belen; one was at Cerrillos; two were in the Sandia Mountains. But thirteen of them apparently originated beneath Albuquerque.

¹ Used in the quarterly "Abstracts of Earthquake Reports for the Pacific Coast and the Western Mountain Region," issued by the U. S. Coast and Geodetic Survey.

LIST OF EARTHQUAKES FELT IN OR NEAR ALBUQUERQUE (Rossi-Forel Intensity Scale)

- 1893, April 8. A Belen shock (intensity VII) was felt in Albuquerque.
 July 12. Three shocks at Albuquerque, one of Intensity VI.
 1906, July 16. A Socorro shock (VIII at Socorro?) was felt here.
 Nov. 15. Another Socorro shock (VII to VIII?) felt here.
 1918, May 28. Severe shock of shallow focus at Cerillos (possibly VIII to IX there) was felt here (IV).
 1930, Mar. 23. Slight.
 Dec. 3. About VI.
 Dec. 4. Slight.
 1931, Jan. 27. III.
 Feb. 3. V.
 Feb. 4. VI to VII.
 1935, Dec. 12 to 1936, Jan. 4. The Belen swarm, with 81 shocks on 24 different days at or near Belen. Of these, seven were felt at Albuquerque, as follows:
 Dec. 17 Dec. 28
 Dec. 18 Dec. 30—most severe one felt here
 Dec. 19 Jan. 4 (1936)
 Dec. 21

- 1936, Sept. 9. IV to possibly V.
 Sept. 11. Three shocks of about III each.
 1938, April 15. Slight.
 April 16. Slight.
 1947, Nov. 6. Slight, in Sandia Mountains.
 1954, Nov. 2. IV.
 Nov. 3. V.
 1956, April 25. Slight, in Sandia Mountains.

Sanford and Holmes (1961) have reported on an instrumental study of the July 1960 swarm of earthquakes at Bernardo and La Joya, between Belen and Socorro. See also their article in this Guidebook.

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