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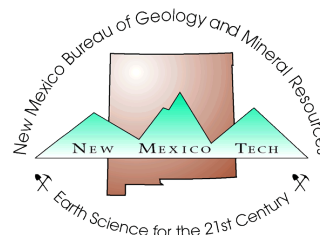
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Information on location and strength of earthquakes in New Mexico prior to 1962 has been reported primarily on the basis of subjective reactions and noninstrumental observations during a shock, and on the degree of damage to structures. Given a number of intensity observations, both the point of maximum intensity and the area of perceptibility can be established. The area of perceptibility is particularly related to the earthquake magnitude (Richter, 1958; Slemmons, 1965; Wiegel, 1970).

A major weakness in determining strength and location from intensity observations is that the method depends on population density. In sparsely settled areas such as much of New Mexico, moderate shocks may go unreported—or reported at low-intensity values that fail to indicate the true strength of the earthquake. Even in areas of relatively high population density, as along the Rio Grande valley, the point of maximum intensity or area of perceptibility may be undefined because of too few observations.

Reliability of early earthquake reports must also be considered. In New Mexico, some of the strong earthquake intensities prior to 1900 are based on reports from local residents tens of years after the shocks occurred (Bagg, 1904). The use of newspaper accounts of earthquakes to estimate intensity has proved fairly reliable. In at least two instances, however, effects of earthquakes in the Rio Grande valley at Socorro were exaggerated in Albuquerque and El Paso newspapers (Sanford, 1963; Ashcroft, 1974).

Despite the imperfect nature of the non-instrumental data, they are valued because they cover a period roughly eight times greater than the instrumental data. Summarized below are noninstrumental data that indicate the nature of seismic activity in New Mexico prior to 1962.

The earliest report of earthquakes in New Mexico is the description of an earthquake swarm in the Rio Grande rift at Socorro by a U.S. Army surgeon. The swarm comprised 22 felt shocks, commencing on December 11, 1849 and lasting until February 8, 1850 (Hammond, 1966). No shock in this swarm was reported felt at distances greater than 25 km from Socorro. Similar sequences of shocks occurring away from population centers along the Rio Grande valley or elsewhere in the state could easily have gone unreported before the advent of instrumental studies.

From 1849 through 1961, Northrop (1961 and 1976) cites evidence, primarily from old newspaper files, for over 600 felt earthquakes in New Mexico. About 95 percent of these

shocks occurred along a 150-km section of the Rio Grande rift from Albuquerque to Socorro: the majority in the 75-km segment from Belen to Socorro. The concentration of reported activity in this area cannot be attributed to population density, for the population from Belen to Albuquerque has always exceeded the population from Belen to Socorro.

Northrop's data in general are influenced by the distribution of population in the state. Population density is higher in the Albuquerque-to-Socorro section of the Rio Grande valley than in most other sections of the state. To reduce bias arising from the distribution of population, only shocks with maximum reported intensities (modified Mercalli) of V or greater are plotted in fig. 1.

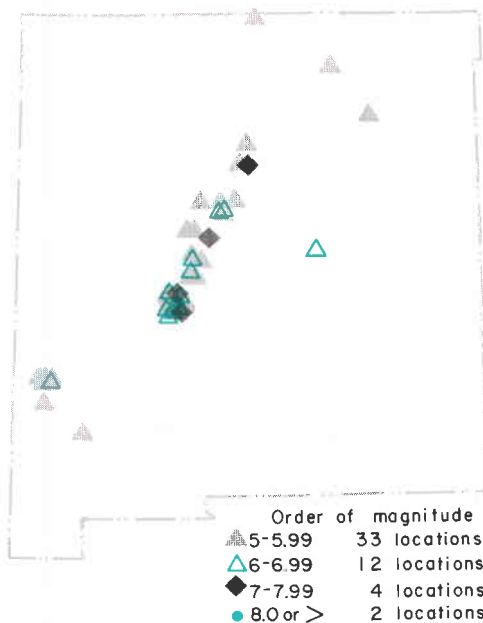


FIGURE 1—LOCATIONS OF EARTHQUAKES REPORTED FELT IN NEW MEXICO PRIOR TO 1962. EPICENTER FOR EACH EARTHQUAKE IS PLACED AT THE POINT OF MAXIMUM REPORTED INTENSITY EXCEPT WHERE A LARGE NUMBER OF SHOCKS ARE REPORTED FROM THE SAME POPULATION CENTER.

Characteristically, the strong Socorro shocks (as well as many other known earthquakes in the rift from Albuquerque to Socorro) are associated with earthquake swarms. As noted for many years, swarms are observed in the vicinity of active volcanoes and in regions that have experienced volcanic activity in geologically recent times (Richter, 1958). The possible significance of the earthquake swarms in the Rio Grande rift is that

they may be related to injection of magma into the crust.

By far the strongest and longest earthquake swarm was the 1906-1907 swarm at Socorro, apparently comparable to the Matsushiro swarm believed by some to have been caused by magmatic intrusion at shallow depth (Stuart and Johnson, 1975). Although the evidence is not absolutely conclusive, the distribution of isoseismals for the 1906-1907 swarm suggests hypocenters beneath the Socorro Mountain horst block, a structural feature in the central part of the rift. Other swarms also appear to have originated in the central part of the rift, rather than the margins. Recent basalt flows from north of Albuquerque to south of Socorro are generally confined to the central part of the rift. This observation, in conjunction with the location of earthquake swarms, may indicate that magma is continuing to be injected into the central portion of the rift.

Most reported earthquakes prior to the beginning of instrumental studies were along the Rio Grande valley, primarily between Albuquerque and Socorro (fig. 1). The concentration of seismic activity in this belt cannot be attributed to population density inasmuch as some reported shocks, particularly at Socorro, were of sufficient strength to be felt over areas up to 245,000 km² (Sanford, Olsen, and Jaksha, 1979). Shocks of this strength are unlikely to have gone undetected anywhere in the state, regardless of population distribution.

This manuscript is an excerpt from Circular 171, Earthquake activity in New Mexico (1849 through 1977), soon to be released.

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