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Earthquake research at New Mexico Institute of Mining and Technology

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EARTHQUAKE RESEARCH AT NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

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INTRODUCTION

The Rio Grande valley between Socorro and Albuquerque is historically the region of highest seismicity in New Mexico. Numerous earthquakes have been felt along the valley, particularly at Socorro and Albuquerque. Prior to 1959, however, no serious instrumental studies of earthquakes in this region had been attempted. In the fall of 1959, Carnegie Institution, Washington, D. C., loaned New Mexico Institute of Mining and Technology a high-magnification seismograph. During a trial period of 650 hours of operation, 49 very small earthquakes were recorded. Eighty percent of these shocks originated within 10 miles of Socorro.

The large number of quakes recorded indicated that high-magnification instruments could give a large amount of information on earthquakes in New Mexico, particularly those quakes originating near Socorro. In the summer of 1960, two high-magnification seismographs were permanently installed in two abandoned mines located two miles west of the main NMIMT campus. These instruments have been in nearly constant operation since that time.

INSTRUMENTATION

The two seismographs being used for earthquake studies at NMIMT are: (1) a single-channel seismograph recording continuously at a slow rate (3.5 mm/sec), and (2) a three-channel seismograph recording intermittently at a high rate (30 mm/sec and 60 mm/sec). The seismograph used for continuous recording consists of a vertical transducer (Willmore seismometer with natural frequency of 1 cps), a high-gain transistor amplifier, and a drum recorder with pen and ink registration. The magnification of this instrument is about eight million at a frequency of 20 cps.

The three-channel seismograph used for high resolution recording consists of three transducers (Willmore seismometers), three high-gain amplifiers, and a high-speed (30 or 60 mm/sec) strip chart recorder with pen and ink registration. The magnification of this instrument is variable with a maximum of about ten million at a frequency of 20 cps. An example of a three-component seismogram for this instrument is shown in Figure 1.

EARTHQUAKE STATISTICS

Most of the earthquake research at NMIMT has been concentrated on the shocks originating within 10 miles of Socorro. The number of quakes with epicenters near Socorro is impressive. In the period from September 15, 1960 to March 20, 1961, 207 of these quakes (with S-phase peak to peak amplitude exceeding 8 mm on the twenty-four hour records) were recorded. Fifty percent of these events occurred within the month of October, 1960. Three of the quakes recorded in the six-month period were suffi-

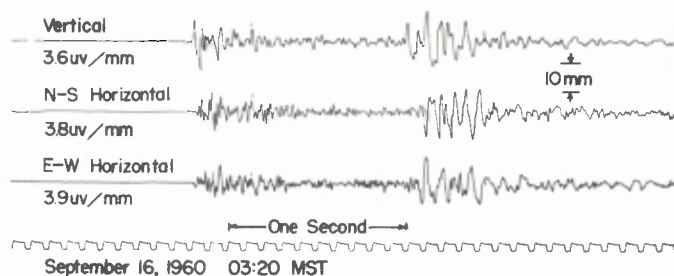


Figure 1. Three-component seismogram for an earthquake with an epicenter five miles southwest of the NMIMT recording station. The energy release for this quake is about 100 million ergs and the magnitude about negative 2 on the Richter scale.

ciently strong to be felt in Socorro: October 25, 1960, 12:21 MST, intensity III (modified Mercalli Intensity Scale); December 19, 1960, 16:28 MST, intensity IV-V; and January 27, 1961, 23:33 MST, intensity III-IV.

High-speed (30 mm/sec and 60 mm/sec) three-component and tripartite recording on the three-channel seismograph has shown that ninety percent of the close quakes, including the three felt in Socorro, originated in a 50-square-mile area southwest of Socorro. This area is part of the narrow elevated fault block which borders the western margin of the Rio Grande valley at Socorro. Preliminary work with the high resolution records also indicates that these quakes had abnormally shallow foci. Depths of focus for nine quakes ranged from 9,000 to 20,000 feet and averaged 12,000 feet.

No lower limit to the magnitude of an earthquake has been detected in the recording to date. The number of earthquakes increases regularly with decreasing energy release down to the limit of recognition of earthquakes on the seismograms. For each one-tenth reduction in energy release, the number of quakes increases by a factor of about five. The energy release for the smallest quakes recorded is less than 10 million ergs which corresponds to a quake of negative 2.9 magnitude on the Richter Magnitude Scale.

Areas with the same degree of seismic activity as Socorro may exist elsewhere between Socorro and Albuquerque. The large number of shocks that originated from the southeast end of the Ladron Mountains in July and August of 1960 (Sanford and Holmes, 1961) suggests that other active areas do exist.

REFERENCE

- Sanford, A. R., and Holmes, C. R., 1961, Note on the July 1960 earthquakes in central New Mexico: *Seismol. Soc. America Bull.*, v. 51, p. 311-314.