

SEISMIC ACTIVITY IN THE PERMIAN BASIN IN NEW MEXICO

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While most earthquakes in New Mexico are due to tectonic forces associated with the Rio Grande Rift and the Socorro Magma Body, in recent years seismic activity has increased in areas where fluid injection is ongoing, raising the possibility that these earthquakes are induced by human activity. The two regions of New Mexico that have seen the largest rise in activity are the Raton Basin, which spans the New Mexico-Colorado border in northeastern New Mexico, and the Permian Basin, which spans the New Mexico-Texas border in southeastern New Mexico. I will discuss the recorded history of seismicity in the Permian Basin in New Mexico, as well as past and ongoing efforts to better understand its causes.

Earthquake monitoring in New Mexico began in the 1960's in the area around the Socorro Magma Body, and a network in southeastern New Mexico began operating in 1998 to monitor the Waste Isolation Pilot Plant (WIPP), a nuclear waste storage facility located southeast of Carlsbad. The WIPP network currently consists of nine short-period sensors and is able to detect many of the potentially induced seismic events in the Permian Basin, making it invaluable for studying the long-term history of seismicity in the region. Temporary seismic networks, including the 3-component broadband SIEDCAR campaign, have also been used to study seismicity in the region.

The largest concentration of seismic activity in the Permian Basin in New Mexico occurred in the Dagger Draw oil field, northwest of Carlsbad. Seismic activity began to increase in 2001, 5 years after peak fluid injection in 1996, suggesting significant fluid migration occurred. Seismic activity at Dagger Draw has since decreased, and activity in other parts of the Permian Basin in New Mexico has generally been moderate. While seismic activity in the Permian Basin has increased dramatically in the past few years, most of the increase has occurred in the Texas portion of the Permian Basin, while up to this point the earthquakes occurring in New Mexico have generally been less frequent and smaller than M2. However, it is important to continue to study the entire region to better understand the causes of induced seismicity and how to mitigate it.

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