CHANGING SEISMICITY NEAR THE MID-AMERICA TRENCH

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RESUMEN *

Después de la ocurrencia del temblor de Oaxaca del 29 de Noviembre de 1978, ocurrió un número relativamente alto de eventos asociados a la trinchera de América Central. 17 temblores de magnitud $m_b \geqslant 5.0$ fueron registrados por el NEIS-USGS en los cuatro meses siguientes. Para el período 1969-1979 se tiene en promedio 8.4 eventos/4 meses con una desviación estándar de 3.2; un valor similar se tiene para el período desde 1963 hasta 1968. Después del temblor de Oaxaca la actividad es superior al promedio, en 2.5 veces la desviación estándar. Esta actividad ocurre a lo largo de toda la trinchera de América Central, lo que sugiere que el temblor de Oaxaca originó un cambio en el esfuerzo regional y que éste fue el adecuado para incrementar la sismicidad asociada a la trinchera de América Central. Se sugiere que el tamaño relativamente pequeño de la placa de Cocos tiene relación con el incremento de la actividad sísmica.

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Following the Oaxaca earthquake of November 29, 1978 signals from an unusual number of earthquakes with locations near the Mid-America Trench were recorded by the seismograph at CIRES. Seventeen events with magnitude m_b 5.0 or more were located by the National Earthquake Information Service of the United States Geological Survey in the four months immediately following the Oaxaca earthquake. Aftershocks of the Oaxaca earthquake or of the earthquake of March 14, 1979 were not included in this count. For the purposes of this study 1 define aftershocks as events which occur within 50 km of the mainshock.

Figure 1 is an histogram of the number of earthquakes per four months near the Mid-America Trench from 1969 to 1979 (magnitude $m_b \geq 5.0$). Data is from the NOAA hypocenter data file, and the PDE listings of the National Earthquake Information Service. Aftershocks of large events are not included. The mean number is 8.4 and the standard deviation is 3.2. A similar level of activity was recorded for 1963 through 1968 (not shown). The large increase in activity following the Oaxaca earthquake is over 2.5 standard deviations above the mean, and is larger than any other four month period since the World Wide Standard Seismic Network began operation. If the frequency of occurrence of moderate earthquakes near the Mid-America Trench is normally distributed, the level of activity after the Oaxaca earthquake has less than one chance in one hundred of occurring by statistical fluctuation.

Most of these events lie far from the aftershock zone of the Oaxaca earthquake and span almost the entire Mid-America Trench boundary of the Cocos plate. I propose that the Oaxaca earthquake created a change in the regional lithospheric stress in the Cocos plate and that this change in stress was adequate to cause an increase in seismicity along the entire Mid-America Trench boundary of the Cocos plate. Other large earthquakes appear in the Figure but none is followed by a similar increase in activity. It may be that these events did not create significant stress change in the Cocos plate leading to a change in seismicity.

If plates behaved prefectly elastically, then stress changes would be transmitted through them at elastic wave speeds. If a stress change in the Cocos Plate originated in the Oaxaca earthquake and caused the

subsequent earthquakes, it must have traveled very quickly. An earthquake in Nicaragua on December 1 1978 lies southeast of Oaxaca and suggests a wave speed of at least 600 km/day. This is in contrast to earthquake migration rates and stress wave speeds suggested by previous authors of 50 to 270 km/year.

Triggering of earthquakes by stress changes inmediately following large earthquakes may not occur on plates with longer boundaries because changes in stress are taken up over a larger area. The small size of the Cocos plate promotes the idea that stress changes in the plate due to the Oaxaca earthquake led to increased seismicity.

A complete report of this study has been submitted as a letter to Physics of the Earth and Planetary Interiors for publication.

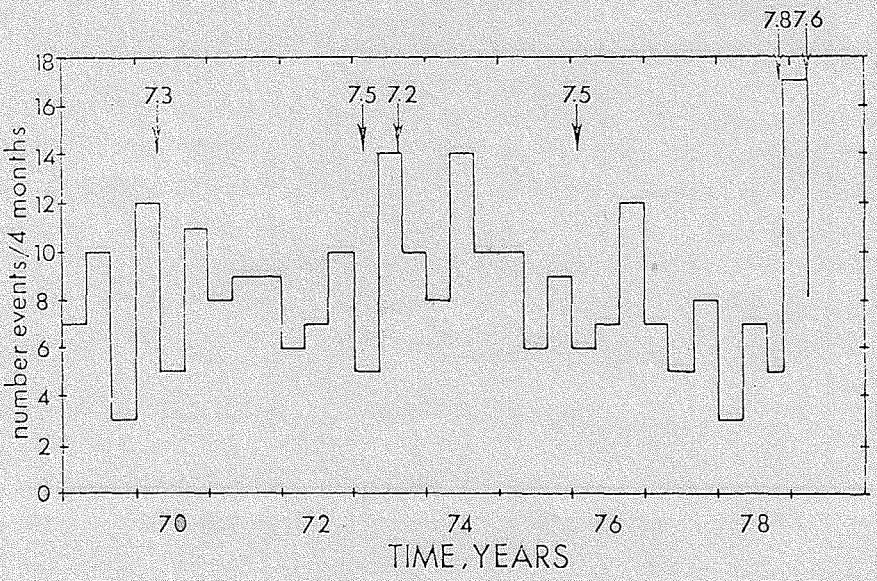

Figure caption: Number of earthquakes of magnitude $m_b \geqslant 5.0$ per four months near the Mid-America Trench since 1969. Time of the largest events and associates surface wave magnitudes are also indicated. Aftershocks (events within 50 km and one month) of these large events are not included.