Recent Earthquake in North Dakota

A small earthquake with a magnitude of 1.5 was recorded in northwestern North Dakota at 7:53 a.m. on Saturday, January 3rd, 2009. The epicenter of this earthquake was located about 11 miles south of the town of Grenora (48.537° N., 103.946° W.) in Williams County (fig. 1). Mike Stickney, Geologist and Director of the Earthquake Studies Office at the Montana Bureau of Mines and Geology in Butte, Montana, came across the event while reviewing seismological data from the seismic monitoring station located at Dagmar, Montana. Mike quickly determined the depth and epicenter of the earthquake from the recorded seismic information and relayed that information to geologists at the NDGS. This event was a small earthquake, in the range of magnitudes generally recorded, but not felt by people. The energy yield equivalent of this earthquake would be equal to 320 pounds of trinitrotoluene (TNT). An approximate real-world example would be somewhere near that of a large blast in a mine or quarry. Although this earthquake was small, it was large enough to be recorded on the Advanced National Seismic System station at Dagmar, MT and at an additional 10 stations belonging to the EarthScope Transportable Array deployed throughout eastern Montana. The epicenter of this earthquake was determined by picking the P-wave first arrivals and, when possible, S-wave arrivals from seismograms generated at the Dagmar and Brockton, MT and Westby, ND seismic monitoring stations (figs. 2 and 3). The earthquake was determined to have originated at a depth of 8.3 miles, putting it about one-third of the way through the Earth’s crust under North Dakota.

Other Earthquakes Recorded in North Dakota

This earthquake is the fifth to have been instrumentally verified to have originated in the state (fig. 4), according to data obtained from recently updated earthquake catalogs (USGS, 2009). The first instrumentally verifiable earthquake occurred on July 8, 1968 with an epicenter near Huff, ND approximately 12 miles south and east of Bismarck. This quake was felt over a relatively wide area (3,000 square miles) in central North Dakota. Some Bismarck residents reported feeling the event, but most evidently did not recognize it as an actual earthquake. (See the answer to X Marks the Spot #16 on page 23 for more information on this, and other recent earthquakes in North Dakota.)
The frequency of low-magnitude earthquakes (from 0 to 2.0) in the U.S. is actually quite low, with an average of around five events being recorded a year. Comparatively, magnitude 2.0 to 4.0 earthquakes have the highest frequency of occurrence, and are recorded on average, over 1,150 times a year (fig. 5). With these numbers it is important to consider that since relatively few small-magnitude earthquakes are reported each year, it does not necessarily mean that they are not occurring. In fact, it is observed that each time we go down one number on the magnitude scale, there is generally a ten-fold increase in the number of earthquakes that do occur. For example, if an earthquake of magnitude 4.0 or greater occurs around once per decade in N.D., then it is likely that there are also 10 other smaller earthquakes of magnitude 3.0 or greater, and 100 earthquakes of magnitude 2.0 or greater that may occur (Stickney, 2009). We simply do not have the seismograph coverage needed to register and record these smaller events both locally and nationally.

More Earthquakes in North Dakota?

It is very likely that we will record more earthquakes in N.D. in the coming years. In fact, just after the USAArray reference seismic station was installed last fall near Maddock, it recorded a small, near mid-crustal earthquake, just east of Goodrich, N.D. (M 2.6). With the unprecedented size and sensitivity of EarthScope’s dense seismic network (fig. 6), it will be exciting to discover how much more activity is occurring in the area.
more we will hear, now that we are truly listening. It is likely that we will record several additional low-magnitude events that, without the presence of the EarthScope transportable array, would typically be beyond our ability to document.

References


“Geologists have a saying - rocks remember.”
Neil Armstrong