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# Quaternary Fault and Fold Database of the United States

**As of January 12, 2017, the USGS maintains a limited number of metadata fields that characterize the Quaternary faults and folds of the United States. For the most up-to-date information, please refer to the interactive fault map.**

## Wabash Valley liquefaction features (Class A) No. 1024

**Last Review Date: 1994-04-15**

***citation for this record:*** **Obermeier, S.F., and Crone, A.J., compilers, 1994, Fault number 1024, Wabash Valley liquefaction features, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 01/04/2021 10:24 AM.**

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| **Synopsis** | Clastic dikes filled with sand and gravel, interpreted to be the result of earthquake-induced liquefaction, occur throughout much of southern Indiana and adjacent parts of Illinois. At least seven and probably eight prehistoric earthquakes have been documented during the Holocene, as well as, at least one during the latest Pleistocene. Nearly all of these liquefaction features originated from earthquakes centered in southern Indiana and Illinois, and not further south in the nearby source region of the great 1811–1812 New Madrid earthquakes. The recognition of different earthquakes is based mainly on defining limits on the timing of liquefaction features in combination with the regional pattern of liquefaction effects, but some earthquakes have been recognized only by geotechnical testing at sites of liquefaction. Prehistoric magnitudes were probably on the order of moment magnitude M 7.5, which greatly exceeds the largest historical earthquakes of M |

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| | 5.5 in the region. The strongest prehistoric earthquakes had epicenters in the vicinity of the lower Wabash Valley, where the valley borders both Indiana and Illinois. The evidence of Quaternary faulting in the Wabash Valley area is based on the presence of liquefaction features. Liquefaction features are evidence of strong shaking, but they do not identify the specific fault that caused an earthquake. Because individual Quaternary faults remain unidentified, it is not possible to define and measure specific attributes (azimuth, length, dip, etc.) for the Wabash Valley liquefaction features. |
| **Name comments** | Includes the southern halves of Indiana and Illinois. There is no known Quaternary surface rupture on faults in the Wabash Valley region. Quaternary faults have recently been reported in southernmost Illinois, near Metropolis (Nelson, 1996 #2837), but none can be linked with liquefaction features throughout the southern halves of Indiana and Illinois. The following discussion focuses on the presence of paleoliquefaction features throughout the study area. On the basis of the strong evidence that these liquefaction features are late Quaternary in age, they are listed as Class A features in this compilation. |
| **County(s) and State(s)** | CLARK COUNTY, ILLINOIS<br>CRAWFORD COUNTY, ILLINOIS<br>JASPER COUNTY, ILLINOIS<br>LAWRENCE COUNTY, ILLINOIS<br>WABASH COUNTY, ILLINOIS<br>WHITE COUNTY, ILLINOIS<br>DAVIESS COUNTY, ILLINOIS<br>GIBSON COUNTY, INDIANA<br>KNOW COUNTY, INDIANA<br>PIKE COUNTY, INDIANA<br>POSEY COUNTY, INDIANA<br>SULLIVAN COUNTY, INDIANA<br>VIGO COUNTY, INDIANA |
| **Physiographic province(s)** | INTERIOR LOW PLATEAUS<br>CENTRAL LOWLAND |
| **Reliability of location** | Poor<br>Compiled at 1:2,700,000 scale.<br><br>*Comments:* Precise location of the structures that produced the strong ground motion, which formed the liquefaction features, is unknown. |

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| **Geologic setting** | The Wabash Valley region in southeastern Illinois and southwestern Indiana has been an area of persistent seismicity (Nuttli, 1979 #756) and the site of several moderate magnitude (M4.5–5.8) historical earthquakes (Taylor and others, 1989 #699; Langer and Bollinger, 1991 #700), but little is known about the causative faults. The most prominent network of faults in the region is the Wabash Valley fault system (Bristol and Treworgy, 1979 #703), a series of north-northeast-trending normal faults that are mapped at the surface. Seismic-reflection data show that the faults are rooted in Precambrian basement and define a 40-km-long, 22-km-wide graben named the Grayville graben (Bear and others, 1997 #2833). Dip-slip displacements on some of the faults are as much as 0.6 km, and laterally offset structural trends suggest 2-4 km of lateral displacement on some faults.<br><br>On the basis of gravity and magnetic data, Braile and others, (1982 #702) proposed that the Wabash Valley fault zone is part of the northeastern arm of a late Precambrian-early Phanerozoic rift complex in the central mid-continent. However subsequent studies indicate that the Wabash Valley faults are the expression of relatively minor tectonic structures and are probably not part of a failed rift arm (Hildenbrand and Ravat, 1997 #2835). At present, the seismicity in the region cannot be directly associated with any bedrock structures at shallow depth, although a geophysical magnetic and gravity lineament seems to be a good candidate (Hildenbrand and Ravat, 1997 #2835), and a possible fault zone has been located at depth (McBride and others, 1996 #2836). The lineament, some 600 km in length, extends from Arkansas into the Wabash Valley, and terminates in the epicentral region of the strongest paleoearthquakes (M~7.5 and 7.1). Alternatively, McBride and others (1996 #2836) have identified structural features in the upper crust that might correlate with the location of a M 5.5 earthquake that occurred in the area on November 9, 1968.<br><br>Some historical seismicity also persists throughout southern Indiana-Illinois, but the strongest events are concentrated in the vicinity of the Wabash Valley. |
| **Length (km)** | km. |
| **Average strike** | |
| **Sense of movement** | No data |

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| | *Comments:* The sense of movement is unknown. Earthquake focal mechanisms for events in the Wabash Valley region indicate dominantly strike-slip and reverse-slip motion (Herrmann, 1979 #733; Taylor and others, 1989 #699; Langer and Bollinger, 1991 #700). Without knowledge of the structural features that are present at hypocentral depths, it is impossible to determine the preferred nodal planes for the focal mechanisms. |
| **Dip** | No data<br><br>*Comments:* The dip and dip direction are unknown because the causal faults have not been identified. |
| **Paleoseismology studies** | Detailed studies of these paleoliquefaction features have been published (Obermeier and others, 1993 #2841; Munson and Munson, 1996 #2838; Pond and Martin, 1997 #1363; Munson and others, 1997 #2839; Obermeier, 1997 #2840; McNulty and Obermeier, 1999 #3906). These studies describe the characteristics and distribution of the dikes and offer magnitude estimates of earthquakes that likely caused the liquefaction. The persistent historical seismicity in the region suggested the possibility of significant seismic source zones in the region. A systematic search for paleoliquefaction features was begun in 1990, and more than 1000 paleoliquefaction dikes have been discovered. The dikes are typically filled with sand and gravel, are planar, and have a near-vertical orientation. In the river-bank exposures, many of the dikes extend as much as 4 m above the source beds. The maximum dike widths exceed 2.5 m at one site, 50 cm at 8 sites and 30 cm at several tens of sites. Liquefaction features from the strongest paleoearthquake, a magnitude of about 7.5 event that struck in about 6,100 yr BP in the Wabash Valley, cover an area that has a diameter of about 300 km; based on the size and distribution of the dikes, the source region for the strongest earthquakes is in the vicinity of Vincennes, Indiana. |
| **Geomorphic expression** | Causative faults do not have any surface expression. The only evidence of the paleoearthquakes (related to the strong ground motion) is liquefaction features exposed along the banks of major rivers in the study area (Obermeier and others, 1991 #601; Munson and others, 1992 #697; Obermeier and others, 1992 #698, 1993 #704; Hajic and others, 1995 #2834; Munson and Munson, 1996 #2838; Munson and others, 1997 #2839; 1997 #2840; McNulty and Obermeier, 1999 #3906). |

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| **Age of faulted surficial deposits** | Holocene and late Pleistocene |
| **Historic earthquake** | |
| **Most recent prehistoric deformation** | latest Quaternary (<15 ka)<br><br>*Comments:* At least seven notable paleoevents probably occurred during the Holocene, and one occurred about 12,000 yr BP. Nearly all events probably had magnitudes in excess of M 6. No historical earthquakes in the Wabash Valley region have been strong enough to cause liquefaction. It is likely that numerous other M 6-7 Holocene earthquakes have struck the region, but did not leave a record because of the lack of liquefiable deposits in large parts of the region. |
| **Recurrence interval** | *Comments:* Studies have not definitively determined recurrence intervals on individual faults, however a regional recurrence interval for M >6 earthquakes of at least every 500-1,000 years is reasonable in the southern half of Indiana and Illinois. |
| **Slip-rate category** | Insufficient data<br><br>*Comments:* Causative faults have not been identified in the Wabash Valley area. In the absence of well-determined data on the timing of paleoevents and the amount of tectonic slip associated with those events, it is impossible to estimate reliable or even meaningful Holocene or late Quaternary slip rates. |
| **Date and Compiler(s)** | 1994<br>Steven F. Obermeier, U.S. Geological Survey, Emeritus<br>Anthony J. Crone, U.S. Geological Survey, Emeritus |
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