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Quaternary Fault and Fold Database of the United States

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Saline River fault zone (Class B) No. 1026

Last Review Date: 2005-05-01

citation for this record: **Crone, A.J., and Wheeler, R.L., compilers, 2005, Fault number 1026, Saline River fault zone, 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.**

Synopsis	Cox and others (2000 #6801) described a northwesterly trending alignment of earthquake epicenters that follow the Saline River in central and southeastern Arkansas and is colinear with the northeastern margin of the Monroe uplift. Geomorphic evidence has been used to suggest that the Monroe uplift is the site of late Quaternary deformation (see feature 1025, Monroe uplift in this compilation). The epicenter alignment is cited as evidence that active structures exist in the area of the Saline River lineament. In their search for surficial expression of these active structures, Cox and others (2000 #6801) described several small-displacement faults having various strikes that are exposed in several road cuts along a 2.2-km-long section of U.S. Highway 425, south of Monticello, Arkansas. The faults and minor deformation exposed in these road cuts and in nearby trenches that they excavated are small-scale features; the relation of these features to deeper structures and to the diffuse regional seismicity are not well

	determined and, therefore, these features (collectively named the Saline River fault zone by Cox and others, 2000 #6801) are classified as Class B features. This classification is further justified because no compelling evidence indicates that the faults visible at the surface are related to a significant seismogenic source that might generate damaging earthquakes.
Name comments	Cox and Van Arsdale (1997 #2805) and Cox and others (1998 #2806) have conducted field studies of small-displacement faults near Monticello, Arkansas and related them to a zone of diffuse seismicity along the Saline River lineament. They informally name the faults the "Saline River fault zone" (Cox and Van Arsdale, 1997 #2805).
County(s) and State(s)	DREW COUNTY, ARKANSAS
Physiographic province(s)	
Reliability of location	Poor Compiled at 1:17,000 scale. *Comments:* The individual features investigated by Cox and others (2000 #6801) are relatively well located on the basis of their descriptions of their field study sites. However, if a Saline River fault zone exists, it is not mapped in any published source. Furthermore, Cox and others (2000 #6801) indicate that they are naming the feature in the reports cited here.
Geologic setting	The faults described in the studies cited here are located in the southern part of the Mississippi embayment in the transition zone of structural styles between the broad downwarp of the embayment to the north and the Gulf of Mexico to the south. In late Precambrian and Early Paleozoic time, this area was located on the rifted margin of North America that flanked the Iapetus Ocean (Thomas, 1989 #2808; 1991 #678). Later in Paleozoic time, compressional tectonics in the Ouachita orogen resulted in the transport of large thrust sheets over the margin of the craton. Starting in Late Triassic to Middle Jurassic time, break-up of the supercontinent Pangea resulted in the initial opening of the Gulf of Mexico. The opening continued through the late Jurassic, and from that time to the present, the northern Gulf of Mexico has been the depocenter for a thick section of primarily terrigenous clastic sediments derived from the North American craton

	(Salvador, 1991 #2807). During the Mesozoic and Cenozoic, the northern Gulf of Mexico and southern margin of the North American craton have been characterized by modest to minor deformation, which is expressed mainly in the form of broad downwarps (for example, the Mississippi embayment) and gentle uplifts (for example, the Monroe uplift). The New Madrid seismic zone, located 300–400 km to the northeast, is the most seismically active region in the central and eastern United States. However, in the vicinity of the study area, only 12 known earthquakes (maximum magnitude of about 4.3) have occurred historically (Cox and others, 2000 #6801).
Length (km)	km.
Average strike	
Sense of movement	Various *Comments:* In road cuts and adjacent trenches, Cox and others (2000 #6801) identified small-displacement faults having reverse and normal senses of movement. Fault strikes range from N. 69° E. for a southerly dipping reverse fault to N. 55° W. for a northerly dipping normal fault. Cox and others (2000 #6801) inferred dextral strike-slip at both outcrop and crustal scales from various observations.
Dip Direction	SW; NW; SE; NE *Comments:* Dips and strikes of small faults in various road cuts and trenches are variable (Cox and others, 2000 #6801). Dips range from a low value of 34° S. on a fault interpreted to be predominantly a lateral slip fault to 70° for a fault interpreted to be transpressional. Similar to the style of displacement and dip amounts, the dip directions are variable. Reverse faults dip north and south; one normal fault in a road cut dips to the north, whereas two normal faults recognized in a shallow seismic-reflection profile dip to the south.
Paleoseismology studies	Six kinds of information define the Saline River fault zone. (1) Small faults are exposed in road cuts and Cox and others (1998 #2806; 2000 #6801) trenched the faults. (2) Twelve small earthquakes align loosely across a distance of 120 km along a northwest-trending line (Cox, 1994 #6799; Cox and others, 2000 #6801). (3) Interpretations of three high-resolution, shear-wave,

seismic-reflection profiles show faults (Cox, 1994 #6799; Cox and others, 2000 #6801; 2004 #6800). (4) Southeast-flowing rivers are preferentially on the southwest sides of their valleys, and Pleistocene terraces are preferentially on the northeast sides of the valleys. Cox (1994 #6799) interpreted this asymmetry to indicate southwest tilting of crustal blocks, one on each side of the southeast-flowing Saline River. (5) Linear river segments parallel to the fault zone expose small faults, folds, and fractures that deform Quaternary sediments (Cox and others, 1998 #2806; 2004 #6800). (6) Sand blows are at the southeastern end of the fault zone (see Class A feature No. 1033, Southeast Arkansas liquefaction features) (Cox and others, 2000 #6801).

The most detailed information concerning the small faults and folds is reported by Cox and others (2000 #6801), who examined deformation at six sites along a 2.2-km-long, north-south transect following the route of U.S. Highway 425, south of the city of Monticello, Arkansas. In road cuts along the highway, they found evidence of deformation and excavated trenches short distances from the highway along the projected strikes of features exposed in the road cuts. They mapped the trench exposures in detail and dated a surficial silt deposit using thermoluminescence. In addition, they collected data along a 210-m-long, shallow, shear-wave seismic-reflection profile that traversed the features that they interpret as the principal fault and a secondary fault.

In some road cuts and trenches, they found no faulting, only stratigraphic relations and contacts that suggest possible warping and minor deformation. In other road cuts or trenches, they found faults that had throws on the order of 0.5 m or more. In general, the scale and extent of deformation seems to be minor to modest and localized. They interpreted a group of three faults at one of the medial sites in their transect to be the principal fault of the Saline River fault zone, and they identified the principal fault trace as striking N. 21° W., dipping 34° S. and having a 20- to 40-cm-wide breccia zone in the Eocene Jackson Formation. They also interpreted moderate to steep dips in the adjacent beds of the Jackson Formation and in the Pliocene-Pleistocene Lafayette gravel as drag folding that is evidence of left transpression.

Interpretation of the seismic-reflection profile revealed two south-dipping normal faults that offset the base of the Jackson Formation a total of about 20 m. The total offset of reflectors appears to decrease in younger units, which suggested to Cox and

	others (2000 #6801) that these faults were active as down-to-the-basin normal faults during Eocene subsidence of the Gulf of Mexico margin. The two faults defined by the seismic-reflection data project upward to the traces of small faults exposed in nearby trenches. Cox and others (2000 #6801) collectively interpreted these various orientations, attitudes, and senses of motion to represent a main fault and secondary faults associated with a northwest-trending primary fault that they inferred is related to the N. 45° W.-trending Saline River seismicity alignment. They speculated that the Eocene-age normal faults have been reactivated as transpressional faults in the contemporary ENE-WSW compressional stress field. They proposed two deformation events that postdate deposition of the late Wisconsinan Peoria Loess, and noted that even though the cumulative vertical offset from these events is less than 1 m, the amount of lateral slip is unknown. Furthermore, they indicated that the features they studied are oblique to the Saline River fault zone and, therefore, could be only part of a discontinuous, en echelon, strike-slip array. Lastly, they cautioned that the Saline River fault zone may be only one of an unknown number of concealed faults that might pose a seismic hazard to the region.
Geomorphic expression	No significant geomorphic expression of faults; the features were only exposed in road cuts along U.S. Highway 425 and in nearby trenches (Cox and others, 2000 #6801). All features have small displacements, in most cases less than 0.5 m. In the absence of the road cuts, these features would not have been identified on the basis of any surficial expression.
Age of faulted surficial deposits	Range in age from Eocene (Jackson Formation), Pliocene-Pleistocene (Lafayette Gravel) through latest Pleistocene deposits that are thought to be Peoria Loess and Loveland Loess (Cox and others, 2000 #6801).
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Based on stratigraphic evidence, Cox and others (2000 #6801) proposed two deformation events younger than deposition of the Peoria Loess, but the evidence of these events is not compelling and the cumulative vertical offset is small (<1 m).

	Without strong corroboration or confirmation of these proposed paleoseismic histories by additional studies, these events must be considered with caution because of the major implications that they have on seismic hazard assessments.
Recurrence interval	Recurrence intervals are not reported because of lack of age control and information about specific faulting events. *Comments:* Recurrence intervals are not reported because of lack of age control and information about specific faulting events.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Impossible to determine or estimate realistic slip rates given the limited stratigraphic control, the uncertain amounts of slip, the generally small amount of cumulative deformation, and the difficulty in identifying specific datums whose offset can be measured with some degree of confidence. Based on the lack of geomorphic expression and the small amount of post-Eocene cumulative throw, the slip rates must certainly be very small, probably much less than 0.1 mm/yr.
Date and Compiler(s)	2005 Anthony J. Crone, U.S. Geological Survey, Emeritus Russell L. Wheeler, U.S. Geological Survey, Emeritus
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