Jump to Navigation

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.

Fluorspar Area fault complex, Rock Creek graben (Class A) No. 1028a

Last Review Date: 1999-12-28

citation for this record: **Nelson, W.J., compiler, 1999, Fault number 1028a, Fluorspar Area fault complex, Rock Creek graben, 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	**General:** In most of the area of the Fluorspar Area fault complex, thin and patchy Quaternary sediments overlie Paleozoic bedrock, and the time of faulting is known only to be post-Pennsylvanian. Younger movement comes to light where the faults pass southwestward into thicker Cretaceous, Tertiary, and Quaternary deposits of the Mississippi Embayment. Mapping in southernmost Illinois, Ross (1963 #3893; 1964 #3894) interpreted Tertiary and possible Quaternary displacements on some faults of the complex. However, Kolata and others (1981 #3886), reviewing the evidence, concluded that no post-Cretaceous tectonism could be demonstrated. Tertiary and Quaternary activity in the Fluorspar Area fault complex finally was documented through detailed geologic mapping combined with test drilling, high-resolution seismic surveys, and trenching (Nelson and others, 1997 #3888; 1999 #3889; 1999 #3918). In Kentucky, geologic quadrangle

	maps depict faults of the Fluorspar Area fault complex displacing the Mounds Gravel, which is of late Miocene to early Pleistocene age (Amos and Wolfe, 1966 #3882; Amos, 1967 #3880; 1974 #3881). Together, these studies reveal multiple episodes of post-Cretaceous tectonic activity in the Fluorspar Area fault complex. Narrow NE- to NNE-trending grabens that contain Tertiary and Pleistocene (Illinoian and older) sediments are characteristic. Several grabens show more than 30 m of dip-slip offset on Pleistocene units; in one case the throw may exceed 150 m. Deformation of Wisconsinan sediments is localized and small, less than 3 m. No Holocene movement has been detected. Nelson and others (1999 #3889) demonstrated Quaternary faulting at seven sites on six fault sections within this fault complex. The lengths of Quaternary ruptures are unknown. Average strikes are given for each section, where available. The sections described here are parallel, independent faults, instead of adjoining sections of the single, contiguous fault. **Sections:** This fault has 6 sections.
Name comments	**General:** The name Fluorspar Area fault complex refers to the multitude of fractures in the fluorspar-mining district of southern Illinois and western Kentucky. Fault orientations vary, but most trend NE-SW in Illinois, curving to ENE-WSW eastward into Kentucky. Most faults dip 65 degrees or steeper and they comprise normal, reverse, strike-slip, and oblique-slip faults, many showing evidence of two or more episodes of movement. Associated with faulting are Permian ultramafic dikes, sills, diatremes, and a large intrusive breccia structure known as Hicks Dome. This was historically the richest fluorite-mining district in the United States. Sizeable quantities of lead, zinc, silver, barite, and other minerals also were mined from vein and bedded-replacement deposits. The Fluorspar Area Fault Complex overlies the junction area of a Proterozoic-Cambrian failed rift complex that consists of the northeast-trending Reelfoot rift and the east-trending Rough Creek graben. Of more than passing significance, the New Madrid seismic zone also lies within the Reelfoot Rift and is directly in line with the Fluorspar Area fault complex. Good overviews of the structure of the Fluorspar Area Fault Complex are found in Hook (1974 #3885), Trace and Amos (1984 #3895), Nelson (1991 #3887), and Potter and others (1995 #3892). **Section:** The Rock Creek graben is a large, complex graben of the Fluorspar Area fault complex. The Rock Creek follows a curving

	path southwestward from Union County, Kentucky into Hardin County, Illinois, back into Kentucky, finally returning to Pope and Massac Counties, Illinois where Quaternary activity is in evidence.
County(s) and State(s)	MASSAC COUNTY, ILLINOIS PULASKI COUNTY, ILLINOIS LIVINGSTON COUNTY, KENTUCKY
Physiographic province(s)	INTERIOR LOW PLATEAUS COASTAL PLAIN
Reliability of location	Good Compiled at 1:250,000 scale. *Comments:* Like other structures of the Fluorspar Area fault complex, the Rock Creek graben is exposed directly in a few places, accurately mapped at some, and covered by surficial materials along much of its trace. Quaternary displacements are known from a single site, the bank of Mallard Creek in NE 1/4 SW 1/4, Sec. 20, T. 15 S., R. 6 E., Massac County, Illinois.
Geologic setting	The area where Quaternary displacements of the Fluorspar Area fault complex are known is at the northern edge of the Mississippi Embayment, an extension of the Coastal Plain. Cretaceous and lower Tertiary sediments of the Embayment overlap mainly Mississippian-age bedrock of the Shawnee Hills. The study area lies just south of the southernmost limit of Pleistocene continental glaciation. All uplands are mantled in wind-blown Pleistocene silt known as loess. Valley bottoms contain a variety of Quaternary fluvial and lacustrine deposits. Following are descriptions of field work done on each section. Section 1028a (Rock Creek graben): A 10-m-wide section of the bank of Mallard Creek was cleared with a backhoe, and we drilled several shallow test holes close to the creek (Nelson and others, 1999 #3889). The test holes did not indicate significant displacement of Quaternary deposits. However, the backhoe exposure showed two episodes of Quaternary faulting. Section 1028b (Barnes Creek fault zone): Exposures in the banks of Barnes Creek were examined repeatedly and logged, and some were improved using hand tools and heavy equipment. No datable material was found. A seismic reflection profile, 2 km long, was conducted along the creek, and numerous test borings were made (Nelson and others, 1997 #3888; 1999 #3889; 1999 #3918).

Kolata and others (1981 #3886) discussed the "Metropolis site", which may be part of the Barnes Creek fault zone. Faults formerly were exposed (at low water) on the bank of the Ohio River near historic Fort Massac in the city of Metropolis. One fault displaced the Mounds Gravel, four others displaced Cretaceous strata but not the Mounds. The faults described by Kolata and others now are covered by concrete and riprap.

Section 1028c (Hobbs Creek fault zone): Ross (1963 #3893; 1964 #3894) and Kolata and others (1981 #3886) reported an outcrop of tilted Mounds Gravel at abnormally low elevation along a narrow, linear valley in line with known faults. Kolata and others conducted seismic and earth-resistivity surveys, but the results were ambiguous, and origin of the structure remained unknown. Nelson (1996 #3898) mapped the area at 1:24,000 scale, finding additional outcrops that strengthened the tectonic hypothesis. A cored test hole drilled in 1995 demonstrated a deep graben filled with Neogene to Quaternary sediment. Follow-up studies included two seismic-reflection surveys, a ground-penetrating radar survey (inconclusive), many shallow test holes, and a second, deeper, cored test hole (Nelson and others, 1997 #3888; 1999 #3889; 1999 #3918).

Section 1028d (Raum fault zone): Post-Cretaceous tectonic faulting along this zone was first identified at the Reineking Hill site (Nelson, 1996 #3898; Nelson and others, 1997 #3888). Geologic mapping farther southwest at 1:24,000 scale (W.J. Nelson and J.M. Masters, unpublished data) indicated that the Mounds Gravel, and locally the Metropolis Formation is faulted. Follow-up studies included a seismic reflection survey, ground-penetrating radar (which yielded no useful data), and numerous test borings (Nelson and others, 1999 #3889).

Section 1028e (Lusk Creek fault zone): Geologic mapping in the Joppa Quadrangle at 1:24,000 scale indicated possible Quaternary displacement along the Lusk Creek (W.J. Nelson and J.M. Masters, unpublished data). The log and samples (incomplete) from a water well at the Maple Grove School suggested a graben. We ran a high-resolution seismic survey and drilled seven shallow test holes along the seismic line. Then we drilled a cored test hole to bedrock at the Maple Grove School.

Section 1028f (Kelley structure): Many test pits and soil borings were made in the railroad cut, then a backhoe removed soil from the entire width of the structure on the north side of the tracks,

	and the geology was logged in detail. Two seismic-reflection profiles were run, one adjacent to the railroad, the other about 0.4 km south of and parallel to the tracks (Nelson and others, 1999 #3889).
Length (km)	km.
Average strike	
Sense of movement	Normal *Comments:* The exposure on Mallard Creek that showed evidence of Quaternary faulting was only 10 m wide and showed two faults that strike N. 25° E., two others that strike N. 55° W., and one that strikes N. 10° E. None of these faults had evidence of slip indicators. Overall, the Rock Creek graben is composed dominantly of high-angle normal faults that trend northeastward.
Dip Direction	E; NE; W; NW *Comments:* The small exposure on Mallard Creek shows faults having a variety of trends.
Paleoseismology studies	
Geomorphic expression	Linear ridges and valleys along the fault zone reflect differential erosion of hard and soft rocks and sediments. Within the Mississippi embayment area, several streams flow parallel with the inferred fault trace, but this may be coincidence. At Mallard Creek the fault zone is not expressed in the topography.
Age of faulted surficial deposits	At Mallard Creek, faults offset a gravel deposit that is younger than the Pleistocene Metropolis Formation (Pleistocene; Illinoian and older) and the McNairy Formation (Cretaceous). Age of the younger gravel is unknown because it lacks dateable material; most likely, the gravel is Wisconsinan in age. The uppermost 1 m of sediment, which almost certainly is Holocene, is not deformed (Nelson and others, 1999 #3889).
Historic earthquake	
Most recent prehistoric deformation	late Quaternary (<130 ka) *Comments:*

Recurrence interval	*Comments:* No individual earthquakes have been recognized, so no recurrence interval can be calculated.
Slip-rate category	Less than 0.2 mm/yr *Comments:* Sediments more than 100,000 yr old are displaced only about 1 m.
Date and Compiler(s)	1999 W. John Nelson, Illinois State Geological Survey
References	#3880 Amos, D.H., 1967, Geologic map of part of the Smithland quadrangle, Livingston County, Kentucky: U.S. Geological Survey Geologic quadrangle Map GQ-657, 1 sheet, scale 1:24,000. #3881 Amos, D.H., 1974, Geologic map of the Burna quadrangle, Livingston County, Kentucky: U.S. Geological Survey Geologic quadrangle Map GQ-1150, 1 sheet, scale 1:24,000. #3882 Amos, D.H., and Wolfe, E.W., 1966, Geologic map of the Little Cypress quadrangle, Kentucky-Illinois: U.S. Geological Survey Geologic quadrangle Map GQ-554, 1 sheet, scale 1:24,000. #3885 Hook, J.W., 1974, Structure of the fault systems in the Illinois-Kentucky Fluorspar District, *in* Hutcheson, D.W., ed., A symposium of the geology of Fluorspar: Kentucky Geological Survey Special Publication 22, p. 77-86. #3886 Kolata, D.R., Treworgy, J.D., and Masters, J.M., 1981, Structural framework of the Mississippi embayment of southern Illinois: Illinois Institute of Natural Resources State Geological Survey Division Circular 516, 30 p. #3887 Nelson, W.J., 1991, Structural styles of the Illinois Basin, *in* Leighton, M.W., Kolata, D.R., Oltz, D.F., and Eidel, J.J., eds., Interior cratonic basins: Tulsa, Oklahoma, The American Association of Petroleum Geologists, Memoir 51, p. 209-243. #3898 Nelson, W.J., 1996, Geologic map of the Reevesville quadrangle, Illinois: Illinois Geologic quadrangle Map IGQ-18, 1 sheet, scale 1:24,000.

#3889 Nelson, W.J., Denny, B.F., Follmer, L.R., and Masters, J.M., 1999, Quaternary grabens in southernmost Illinois—Deformation near an active intraplate seismic zone: Tectonophysics, v. 305, p. 381-397.

#3888 Nelson, W.J., Denny, F.B., Devera, J.A., Follmer, L.R., and Masters, J.M., 1997, Tertiary and Quaternary tectonic faulting in southernmost Illinois: Engineering Geology, v. 46, p. 235-258.

#3918 Nelson, W.J., Harrison, R.W., and Hoffman, D., 1999, Neotectonics of the northern Mississippi embayment: Illinois State Geological Survey Guidebook 30, 34 p.

#3892 Potter, C.J., Goldhaber, M.B., and Heigold, P.C., 1995, Structure of the Reelfoot-Rough Creek Rift System, Fluorspar Area Fault Complex, and Hicks Dome, southern Illinois and western Kentucky—New constraints from regional seismic reflection data, *in* Shedlock , K.M., and Johnston, A.C., eds., Investigations of the New Madrid Seismic Zone: U.S. Geological Survey Professional Paper 1539-Q, p. 19, 1 pl.

#3893 Ross, C.A., 1963, Structural framework of southernmost Illinois: Illinois State Geological Survey Circular 351, 28 p.

#3894 Ross, C.A., 1964, Geology of the Paducah and Smithland quadrangles in Illinois: Illinois State Geological Survey Circular 360, 32 p., 1 pl., scale 1:62,500.

#3895 Trace, R.D., and Amos, D.H., 1984, Stratigraphy and structure of the western Kentucky Fluorspar District: U.S. Geological Survey Professional Paper 1151-D, 41 p., 1 pl., scale 1:48,000.