

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](#).

Crooked Creek fault (Class B) No. 1032

Last Review Date: 1998-09-22

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Synopsis	This feature is classified as a Class B feature because of the uncertainty concerning the cause of the subsurface deformation. As discussed below, it is uncertain if the stratigraphic offset related to the Crooked Creek fault is solely the result of dissolution of soluble subsurface strata or is related to genuine, deep-seated tectonic movements (Frye and Hibbard, 1941 #2810). The fault is defined largely on the basis of drill-hole data (Izett and Honey, 1995 #2812) and anomalous geomorphic features above the subsurface structure. No exposures of the fault are known. Deformation associated with the feature has resulted in a structural depression in the subsurface and an elongate topographic trough (Smith, 1940 #2813).
Name comments	Also called the Crooked Creek-Fowler fault by Gutentag and others (1981 #2811).
County(s) and	FORD COUNTY, KANSAS

State(s)	MEADE COUNTY, KANSAS
Physiographic province(s)	GREAT PLAINS
Reliability of location	<p>Poor Compiled at 1:24,000 scale.</p> <p><i>Comments:</i> Subsurface location of the fault is based on scattered drill-hole data that indicates the presence of an anomalously large change in the elevation of stratigraphic units between adjacent drill holes (Izett and Honey, 1995 #2812). This large change suggests the presence of a fault because stratigraphic units throughout the region are nearly flat-lying, having regional dips of only 1.8-3.6 m per km (Smith, 1940 #2813).</p>
Geologic setting	<p>The oldest exposed rocks in the Meade County area are Lower Permian sedimentary rocks, although older Paleozoic rocks are present in the subsurface. Shallow seas covered the region periodically during Paleozoic time, and in Permian time, there was a progressive transition to non-marine sedimentation. At times during this transition, extensive evaporation of isolated inland seas resulted in the deposition of salt and gypsum (Hutchinson Salt Member of the Wellington Formation; estimated to be about 165 m thick based on geophysical logs shown in Figure 3 of Izett and Honey, (1995 #2812). Non-deposition and erosion during much of the Mesozoic created an unconformity between Paleozoic rocks and the overlying Tertiary sediments (Frye, 1942 #2809). The Miocene-age, silty sandstone and gravel that comprise the Ogallala Formation are the most widespread Tertiary rocks in southwestern Kansas. In the area of the Crooked Creek fault in Meade County, the Ogallala Formation is overlain by claystone, siltstone, sand, and gravels of the Pliocene Rexroad Formation and Stump Arroyo Member, and the Pliocene/Pleistocene Crooked Creek Formation (Izett and Honey, 1995 #2812). All of these materials are generally undeformed and nearly flat lying.</p>
Length (km)	44 km.
Average strike	
Sense of movement	<p>No data</p> <p><i>Comments:</i> The sense of movement on the inferred fault is not well known because the Crooked Creek fault is only known from</p>

subsurface data. Stratigraphic relations based on subsurface data suggest a significant vertical offset (the amount of offset is not explicitly stated), but no information exists to determine if the offset is the product of normal or reverse slip. Based on the current topography, the southern part of the fault would have a down-to-the-west vertical offset. The stratigraphic offsets between adjacent drill holes in the area are certainly suggestive of faulting, but as Smith (1940 #2813) correctly observes, some of the structural depression in the subsurface could be described as a structural trough, and the depression may not be caused wholly by faulting. The exact origin of the stratigraphic offset remains uncertain. Some authors propose that these offsets are related to tectonic faulting (Haworth, 1896 #2814; Smith, 1940 #2813) whereas others propose that they are the result of dissolution of evaporite minerals in the Permian rocks (Gutentag and others, 1981 #2811; Izett and Honey, 1995 #2812). Smith (1940 #2813, p. 133-136) summarized the strengths and weaknesses of the interpretations of faulting and dissolution to explain the Crooked Creek fault.

Dip

No data

Comments: For reasons similar to those described under "sense of movement," the dip of the fault is unknown.

Paleoseismology studies

Geomorphic expression

An abrupt, anomalous change in the course of Crooked Creek in Meade County, an area of unusual artesian flow of groundwater, and unusual surficial depressions (sinkholes) first drew attention to the area of the Crooked Creek fault. The prevailing topographic slope in southwestern Kansas is about 2.37 m/km in a southeasterly direction (Gutentag and others, 1981 #2811). The upper 30-40 km of Crooked Creek flows in a generally east to southeasterly direction, but at the eastern border of Meade County about 10 km north of the town of Fowler, the stream valley turns abruptly to the southwest, and maintains this flow direction for about 45 km before it turns abruptly and again flows to the southeast. The anomalous southwesterly flowing reach of the stream coincides with the area of artesian aquifers and the area of sinkholes. The spatial coincidence of these unusual geomorphic features and the groundwater condition suggest a common explanation.

	<p>The exact cause of the unusual geomorphology in the area still remains uncertain. Haworth (1896 #2814) first suggested that these features could be related to faulting, whereas other authors contend that dissolution of subsurface evaporites and subsequent collapse of overlying strata have played a major role in the area's geomorphology (Frye, 1942 #2809). Gutentag and others (1981 #2811) and Izett and Honey (1995 #2812) report that the stratigraphic offsets are only the result of dissolution of subsurface evaporites.</p>
<p>Age of faulted surficial deposits</p>	<p>The age of the youngest faulted deposits is uncertain. If the stratigraphic offsets are solely caused by dissolution, then Holocene deposits are "faulted" because sinkholes have formed during historical time (Frye, 1942 #2809). The geological history related to the Crooked Creek fault is poorly known, but Smith (1940 #2813) suggests that the late stages of movement history included ". . . renewal of downward movement along the southern part of the trough in early Pleistocene time, leading to the deposition of the Odee formation; and continued movement in later Quaternary time, outlining the details of the present topography . ." Frye and Hibbard (1941 #2810 p. 397) state that "The latest movement along the Crooked Creek fault occurred in the Recent epoch, displacing the Pleistocene formations and again giving surface expression to the basin."</p>
<p>Historic earthquake</p>	
<p>Most recent prehistoric deformation</p>	<p>Unspecified</p> <p><i>Comments:</i> Because of the uncertainty related to the origin of the Crooked Creek fault, it is not possible to assign a time of the most recent paleoevent.</p>
<p>Recurrence interval</p>	<p><i>Comments:</i> Because of the uncertainty related to the origin of the Crooked Creek fault, it is not possible to assign a recurrence interval.</p>
<p>Slip-rate category</p>	<p>Insufficient data</p> <p><i>Comments:</i> Because of the uncertainty related to the origin of the Crooked Creek fault, it is not possible to assign a slip rate.</p>
<p>Date and</p>	<p>1998</p>

Compiler(s)	Anthony J. Crone, U.S. Geological Survey, Emeritus
References	<p>#2809 Frye, J.C., 1942, Geology and ground-water resources of Meade County, Kansas: Bulletin of the University of Kansas, State Geological Survey of Kansas 45, 152 p.</p> <p>#2810 Frye, J.C., and Hibbard, C.W., 1941, Pliocene and Pleistocene stratigraphy and paleontology of the Meade basin, southwestern Kansas, <i>in</i> 1941, Reports of studies: State Geological Survey of Kansas Bulletin 38, p. 390-424.</p> <p>#2811 Gutentag, E.D., Lobmeyer, D.H., and Slagle, S.E., 1981, Geohydrology of southwestern Kansas: Kansas Geological Survey Irrigation Series 7, 73 p., 3 pls.</p> <p>#2814 Haworth, E., 1896, Local deformation of strata in Meade County, Kansas and adjoining territory (preliminary): American Journal of Science, v. 2, p. 368-373.</p> <p>#2812 Izett, G.A., and Honey, J.G., 1995, Geologic map of the Irish Flats NE quadrangle, Meade County, Kansas: U.S. Geological Survey Miscellaneous Investigations Map I-2498, scale 1:24,000.</p> <p>#2813 Smith, H.T.U., 1940, Geological studies in southwestern Kansas: Bulletin of the University of Kansas, State Geological Survey of Kansas 34, 212 p.</p>

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