Meers Fault; Inactive, Creeping, or Sleeping Monster Fault

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The Meers fault is one of few seismogenic structures with Holocene surface expression in the stable mid-continent of North America. It is a part of a major fault system that forms a boundary between the Wichita uplift and the Anadarko Basin in southwestern Oklahoma. Although seismicity along the Meers fault is infrequent, Late Quaternary deposits show a large offset with a sharp fault scarp which may have formed by a magnitude 7 earthquake. Previous studies reveal that the last fault movement occurred about 1300 years ago with 5-7 m of horizontal movement and similar vertical displacement. This fault is located 5 to 20 km from major infrastructure and threatens two artificial lakes (Lawtonka and Ellsworth), Fort Sill army base, and Lawton city (pop. 94.000). Recent mapping in southwestern Oklahoma shows more than 35 km of prominent scarp affecting Late Quaternary deposits. Modern morphotectonic features and high-resolution topographic data (1-meter resolution) show sharp, fresh fault scarps in a region with significant erosion rate due to863mm rain and 50mm snow annually. This presentation highlights the importance of the Meers fault as a potentially active and dangerous fault. In addition to the hazard it poses to the immediate region, the Meers fault also offers important insights into other E-W trending faults to the north, near Oklahoma City, which are seismically active. The primary objective of this research is to better understand the dynamics and evolution of the Meers fault and use this information to better estimate seismic hazard and recurrence as well as better assess risk. Assessing the earthquake threat posed by the Meers fault requires understanding the characteristics and history of recent displacements that created the scarp. Because there is little data for this fault, detailed structural mapping including preserved morphotectonic features and measuring strain accumulation or creep rate on the fault plane is crucial to understanding of Meers fault dynamics.

(a) Regional tectonic index map with highlighted Meers fault. SOA: Southern Oklahoma Aulacogen, SGR: Southern Granite-Rhyolite province, CU: Cimarron Uplift, SGU: Sierra Grande uplift, UU: Uncompahgre uplift. (b) Satellite image of the Meers fault, southeastern Oklahoma.