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Quaternary Fault and Fold Database of the United States

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Great Salt Lake fault zone, Fremont Island section (Class A) No. 2369b

Last Review Date: 2004-04-01

Compiled in cooperation with the Utah Geological Survey

citation for this record: **Black, B.D., Hecker, S., and Christenson, G.E., compilers, 2004, Fault number 2369b, Great Salt Lake fault zone, Fremont Island section, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 02:57 PM.**

Synopsis	**General:** This is a zone of Holocene faulting beneath Great Salt Lake that was identified from seismic-reflection profiling. Subsidiary faulting is common in the hanging wall west of the main fault in the southern Great Salt Lake. The faults may step to the west and connect with the Oquirrh fault zone [2398] to the south. The entire fault zone appears to have been active in the latest Pleistocene or Holocene (<15 ka). **Sections:** This fault has 3 sections. Dinter and Pechmann (1999

	#4526; 1999 #4645; 2000 #4646) indicate the active East Great Salt Lake fault trace west of Antelope Island shows a 2-km-wide step to the west, suggesting the fault may form two north-northwest trending sections south of Promontory Point: a 35-km-long Antelope Island section and a 30-km-long Fremont Island section. A right step west of Promontory Point suggests that a northern Promontory section probably exists north of the Fremont Island section, although no high-resolution seismic profiles exist for the Promontory section. High-resolution seismic profiles show a sharp westward bend in the southern end of the fault indicating a step-over to the Oquirrh fault zone [2398].
Name comments	**General:** **Fault ID:** Refers to fault number 6-8 of Hecker (1993 #642).
County(s) and State(s)	BOX ELDER COUNTY, UTAH DAVIS COUNTY, UTAH WEBER COUNTY, UTAH
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:89,700 scale. *Comments:* The mapped traces are from high-resolution seismic reflection lines located using GPS by Dinter and Pechmann (1999 #4526; 1999 #4645; 2000 #4646; unpublished mapping, 1:95,000 scale).
Geologic setting	Generally north-trending normal faults beneath Great Salt Lake identified from seismic reflection data. Subsidiary faulting is common in the hanging wall west of the main fault in the southern Great Salt Lake.
Length (km)	This section is 30 km of a total fault length of 103 km.
Average strike	N21°W (for section) versus N29°W (for whole fault)
Sense of movement	Normal
Dip Direction	W *Comments:* A steeply west-dipping fault is evident on seismic reflection profiles but dips are not reported. Interpretation of reflection data suggests the fault may flatten with depth (Smith

	and Bruhn, 1984 #4561) and merge into a horizontal detachment at a depth of about 6 km (Viveiros, 1986 #4649). However, the evidence is equivocal.
Paleoseismology studies	
Geomorphic expression	Subaqueous. Evidence of repeated displacements in post-Bonneville time (Dinter and Pechmann (1999 #4526; 1999 #4645; 2000 #4646). No scarps are preserved on the lakebed west of Fremont Island where the fault is buried beneath horizontal lake-bottom sediments, indicating that movement on this part of the fault may predate movement on the Antelope Island section [2369c] to the south. Diapiric domes and lake-bottom piercement structures, identified from seismic data, developed at least partly from flowage of the salt deposits during construction of the Southern Pacific Causeway in 1957-1959 (Mikulich, 1974 #4492).
Age of faulted surficial deposits	Holocene. Cores collected in August 2000 by Dinter and Pechmann (2000 #4646) may yield dates and improve the geologic interpretation.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* High-resolution seismic data show stratigraphic and structural anomalies, including auxiliary faults and tectonically produced angular unconformities and on-lap surfaces, that indicate at least three surface-faulting earthquakes on the Fremont Island section since the disappearance of Lake Bonneville (Dinter and Pechmann, 2000 #4646).
Recurrence interval	3.8-5.6 ky (<9.2-9.3 ka) *Comments:* Dinter and Pechmann (2000 #4646) indicate three events have occurred since 9.2-9.3 ka. Section lengths are comparable to those of the Wasatch fault zone [2351] and suggest comparable earthquake magnitudes. This recurrence interval is preliminary pending dating of deposits obtained from cores collected in August 2000.
Slip-rate	Between 0.2 and 1.0 mm/yr

category	*Comments:* A preliminary vertical slip rate of 0.67+0.06 mm/yr and a fault-parallel slip rate of 0.9+0.2 mm/yr are estimated by Dinter and Pechmann (2000 #4646). Slip rates are preliminary pending dating of deposits obtained from cores in August 2000.
Date and Compiler(s)	2004 Bill D. Black, Utah Geological Survey Suzanne Hecker, U.S. Geological Survey Gary E. Christenson, Utah Geological Survey
References	#4526 Dinter, D.A., and Pechmann, J.C., 1999, Sublacustrine paleoseismology—Evidence for recent earthquakes on the East Great Salt Lake fault, Utah: Association of Engineering Geologists, 42nd Annual Meeting Abstracts with Program, p. 62-63. #4645 Dinter, D.A., and Pechmann, J.C., 1999, Multiple Holocene earthquakes on the East Great Salt Lake fault, Utah—Evidence from high-resolution seismic reflection data: Eos, Transactions of the American Geophysical Union, v. 80, no. 46, supplement, p. F734. #4646 Dinter, D.A., and Pechmann, J.C., 2000, Late Quaternary slip rates and recurrence intervals of large earthquakes on the East Great Salt fault, Utah—Estimates from high-resolution seismic reflection data: Geological Society of America, Abstracts with Programs, 2000 Annual Meeting, v. 32. #8527 Dinter, D.A., and Pechmann, J.C., 2005, Segmentation and Holocene displacement history of the Great Salt Lake fault, Utah, *in* Lund, W.L. (ed.), Proceedings, Basin and Range Province Seismic Hazard Summit II: Utah Geological Survey Miscellaneous Publication MP05-2 5 pp. (extended abs.). #642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. #4492 Mikulich, M.J., and Smith, R.B., 1974, Seismic-reflection and aeromagnetic surveys of the Great Salt Lake, Utah, *in* Seismic-Reflection and Aeromagnetic Surveys of the Great Salt Lake, Utah: Geological Society of America Bulletin, p. 991-1002, 1 pl.

	#4561 Smith, R.B., and Bruhn, R.L., 1984, Intraplate extensional tectonics of the western U.S. Cordillera-Inferences on structural style from seismic-reflection data, regional tectonics and thermal-mechanical models of brittle-ductile deformation: Journal of Geophysical Research, v. 89, no. B7, p. 5733-5762. #4649 Viveiros, J.J., 1986, Cenozoic tectonics of Great Salt Lake from seismic-reflection data: Salt Lake City, University of Utah, unpublished M.S. thesis, 81 p.