2024 UTAH EARTHQUAKE WORKING GROUP MEETINGS
UTAH QUATERNARY FAULT PARAMETERS WORKING GROUP
SUMMARY

Monday, February 5, 2024
Utah Department of Natural Resources Building, Auditorium
1594 W. North Temple, Salt Lake City, Utah

WELCOME AND INTRODUCTION

Adam Hiscock (Utah Geological Survey [UGS]) called the 2024 Utah Quaternary Fault Parameters Working Group (UQFPWG) meeting to order at 8:30 a.m. Mountain Standard Time (MST). This meeting was held at the Utah Department of Natural Resources Building Auditorium, with an additional hybrid virtual component using the Google Meet platform. After welcoming Working Group members and guests, he summarized the agenda for this year's meeting and the UQFPWG's past activities, purposes, as well as goals for the future. He noted that this group did not meet in 2023, and this was the first meeting of the UQFPWG since 2022.

UQFPWG Purpose and Goals

- Serves as a committee to help set and coordinate Utah's earthquake-hazard research agenda.
- Reviews ongoing paleoseismic, earthquake timing, and fault characterization in Utah, with the goal of updating the Utah consensus slip-rate and recurrence-interval database as necessary.
- Provides advice/insight regarding technical issues related to fault behavior in Utah and the Basin and Range Province.
- Identifies and prioritizes faults for future research in Utah.
- Group depends on the active involvement of researchers (academic, governmental, etc.), consultants, and the public.

U.S. Geological Survey (USGS) Update

Chris DuRoss, Intermountain West (IMW) Regional Coordinator for the U.S. Geological Survey (USGS) Earthquake Hazards Program (EHP) gave an update on the status of the External Grants Program for the last (Fiscal Year [FY] 2023) and current (FY2024) fiscal year funding cycles, as well as information on the upcoming (FY2025) funding announcement for proposals. He mentioned the USGS is currently soliciting feedback on the External Grants process and IMW research priorities, and to reach out to him via email (cduross@usgs.gov) with feedback.

TECHNICAL PRESENTATIONS

Presentations available at UQFPWG Website:
https://geology.utah.gov/hazards/info/workshops/working-groups/q-faults/

- Towards an Improved Salt Lake Valley Community Velocity Model Through Seismic and Gravity Joint Inversion, Part I— New Geological Constraints and Geophysical Data: Adam McKean, Christian Hardwick, and Kayla Smith, Utah Geological Survey
- Towards an Improved Salt Lake Valley Community Velocity Model Through Seismic and Gravity Joint Inversion, Part 2—Seismic Data and Joint Inversion: Fan-Chi Lin, University of Utah

- Intrabasin Faulting Beneath Salt Lake City—New Seismic Data Map the West Valley and Downtown Fault Systems: Lee Liberty, Boise State University
- New Paleoseismic Data and Challenges from the Urban Taylorsville Fault, West Valley Fault Zone, Utah: Emily J. Kleber and Adam I. Hiscock, Utah Geological Survey
- The Great Salt Lake as a Recorder of Sublacustrine Surface Rupture and Strong Shaking in the Wasatch Front Region: Chris DuRoss, U.S. Geological Survey
- The Most Recent Rupture of the Thousand Lake Fault (Post-LGM)—Examining Rupture Length and Average Displacement using Southern Utah Lidar Data: Nathan Toke, Utah Valley University
- Utah Quaternary Fault Mapping Updates, Including Cache Valley and Southern Utah: Adam I. Hiscock, Utah Geological Survey
- Utah Paleoseismic Sites Database and Utah Earthquake Early Warning (EEW) Feasibility Study Updates: Adam I. Hiscock, Utah Geological Survey
- Updating the Working Group on Utah Earthquake Probabilities Forecast for the Wasatch Front: Ivan Wong, Lettis Consultants, LLC
- Quaternary Faults of the Uncompahgre Plateau, Utah and Colorado—Are they Q and are they Faults?: Jim McCalpin, GeoHaz Consulting/Colorado Geological Survey

DISCUSSION ITEMS

Adam Hiscock led a discussion in the afternoon addressing topics that were brought up throughout the meeting, as well as fault investigation priorities for the FY2025 USGS funding announcement. Several noteworthy topics came up in the discussion on priority faults, including adding wording to prioritize faults that cross critical infrastructure zones, and adding priority wording for better study of faults with possible listric geometry in the Basin and Range and Utah. Alex Hatem (USGS) mentioned that all the faults listed in Table 1 (below) are already in the 2023 National Seismic Hazard Maps (NSHM) update and mentioned adding priority wording for faults that are not in the 2023 NSHM update.

UQFPWG 2025 FAULT INVESTIGATION PRIORITIES FOR USGS IMW EXTERNAL GRANTS

The Working Group's list of highest priority fault investigations is largely the same from 2023, which was carried over from 2022 due to the UQFPWG not meeting in 2023.

- Acquire new paleoseismic information for areas with ongoing or completed lidar fault mapping projects:
    - Cache Valley faults – East Cache fault zone and West Cache fault zone
    - Five central segments of the Wasatch fault zone – Brigham City, Weber, Salt Lake City, Provo, and Nephi
    - Oquirrh fault zone
    - Washington, Hurricane, and Sevier fault zones
    - Thousand Lake fault

- "Salvage paleoseismology" (i.e., earthquake timing investigations as rapid development is encroaching on unmodified paleoseismic trenching sites:
    - West Valley fault zone – Granger and Taylorsville faults
    - Cache Valley faults – East and West Cache fault zones

- Use recently acquired lidar data to more accurately map fault traces. Specifically:
    - Basin and Range – Colorado Plateau Transition faults (Thousand Lake fault, Paunsaugunt fault, Joes Valley faults, etc.)
    - Faults in rural areas of western Utah (Escalante Desert, Sevier Desert, Pilot Valley, Tintic Valley, Skull Valley, Hansel Valley, Beaver Basin, Scipio Valley)
    - Faults that cross zones of critical infrastructure across Utah

- Opportunistic trenching sites – Funding for dating samples left over from other projects that have been stored and would be useful:
    - Joes Valley – U.S. Bureau of Reclamation Work?
    - Various research trenches on the Wasatch and West Valley fault zones

- Post-Magna earthquake research – Use geophysical methods to collect more data about the subsurface of the Salt Lake Valley:
    - 3D Basin structural model of the Salt Lake Valley using new gravity, existing well data, and seismic data
    - Community velocity model input improvements
    - Collect, compile, and analyze new geological and geophysical data to improve subsurface models of the Salt Lake basin. Improved basin models will enable more accurate numerical ground motion modeling and may provide insight into subsurface fault geometries.

- Utah Lake faults – Improve upon previous work to better map/characterize these faults. Use new methods and techniques to improve upon previous work on these faults.

- Quaternary faults in Utah not included in 2023 NSHM Update – Paleoseismic data and lidar-based fault geometry mapping needed for including these faults in the next update to the NSHM.

This list does not include other priorities that have carried over from previous years, which are identified in Table 2.

WORKING GROUP PRODUCTS AND RELATED DATA

The final agenda, speaker presentations, and this summary document are available on the UQFPWG web page at https://geology.utah.gov/hazards/info/workshops/working-groups/q-faults/. Paleoseismic investigations that developed out of the UQFPWG meetings and published by the UGS are available in the *Paleoseismology of Utah* series at https://geology.utah.gov/hazards/info/paleoseismology/. Most of the USGS-funded investigations for Utah that were not published by the UGS are compiled in UGS Miscellaneous Publication 13-3 https://doi.org/10.34191/MP-13-3).

Utah Quaternary Fault and Fold Database

The UGS has periodically updated the *Utah Quaternary Fault and Fold Database,* which is now part of the *Utah Geologic Hazards Portal*, with the most recent update being in December 2021, incorporating new mapping and fault attributes. Continuous and ongoing updates are being reviewed by the UGS for Quaternary faults mapped in peer-reviewed publications from 2013 to 2024. Users of any Quaternary fault trace and related data acquired from the UGS or the Utah Geospatial Resource Center (UGRC) State Geographic Information Database (SGID) in the past are advised to use the updated database available from the UGRC SGID (https://gis.utah.gov/data/geoscience/quaternary-faults/). This

single, comprehensive feature class will be periodically updated as new and/or updated data become available and replaces the six previously available feature classes of variable completeness. Additionally, the *Utah Quaternary Fault and Fold Database* is available to view in a webmap application through the *Utah Geologic Hazards Portal* at https://geology.utah.gov/apps/hazards/.

MEETING ATTENDANCE

Registration for the meeting was completed through Eventbrite. Below is a list of in-person and virtual attendees who registered for the meeting. Specific attendance was not taken. **Denotes meeting speaker.*

In-Person Attendees:

Adam Hiscock*	Utah Geological Survey
Adam McKean*	Utah Geological Survey
Alexandra Hatem	U.S. Geological Survey
Ben Erickson	Utah Geological Survey
Caleb Reaveley	IGES Inc.
Chris DuRoss*	U.S. Geological Survey
Claire Decker	Utah Geological Survey
Eduardo Guerrero	Oregon Department of Geology and Mineral Industries
Emily Kleber*	Utah Geological Survey
Enrique Chon	Colorado Geological Survey
Fan-Chi Lin*	University of Utah
Greg McDonald	Utah Geological Survey
Gregory Pyle	IGES Inc.
HyeJeong Kim	University of Utah
Ivan Wong*	Lettis Consultants International, Inc.
James Pechmann	University of Utah
Kristi Rasmussen	Utah Geological Survey
Lee Liberty*	Boise State University
Maria Jaimes	IGES Inc.
Matthew Holli	IGES Inc.
Matthew Morriss	Utah Geological Survey
Michael Hylland	Utah Geological Survey
Mike Stickney	Montana Bureau of Mines and Geology
Nathan Toke	Utah Valley University
Patrick Emery	Gordon Geotechnical Engineering
Rich Giraud	Utah Geological Survey (retired)
Rich Koehler	Nevada Bureau of Mines and Geology/University of Nevada Reno
Scott Miller	University of Utah
Skadi Kobe	Utah Geological Survey
Sofia Agopian	Utah Geological Survey
Stefan Kirby	Utah Geological Survey
Steve Bowman	Utah Geological Survey
Stormie Elmer	Utah Geological Survey

Taylor Nordquist	Applied Geotech
Torri Duncan	Utah Geological Survey
Yann Gavillot	Montana Tech University
Zach Lifton	Idaho Geological Survey

Virtual Attendees:

Alba Mar Rodriguez Padilla	Caltech/Utah State University
Ana Vargo	U.S. Department of Agriculture - Natural Resources Conservation Service
Austin Elliott	U.S. Geological Survey
Ben Laabs	U.S. Bureau of Reclamation
Bob Carey	Utah Division of Emergency Management
Carl Ege	Utah Division of Water Resources
Charles Williamson	Utah Division of Water Rights
Christian Hardwick	Utah Geological Survey
Colby Schwaderer	Wyoming State Geological Survey
Daren Rasmussen	State of Utah
Doug Hawkes	AGEC
Ellen Lamont	U.S. Bureau of Reclamation
Greg Schlenker	GCS Geoscience
James McCalpin*	GEO-HAZ Consulting, Inc.
John Crofts	Utah Division of Emergency Management
Joshua Bregger	U.S. Department of Agriculture - Natural Resources Conservation Service
Julia Frazier	BGC Engineering
Kristine Pankow	University of Utah Seismograph Stations
Michael Cline	U.S. Bureau of Reclamation
Michael Vadman	U.S. Bureau of Reclamation
Nadine Reitman	U.S. Geological Survey
Nick Ellett	U.S. Bureau of Reclamation
Rich Briggs	U.S. Geological Survey
Shadrach Ashton	Utah Geological Survey
Srisharan Shreedharan	Utah State University
Susanne Janecke	Utah State University
Suzanne Hecker	U.S. Geological Survey
Tabor Reedy	U.S. Bureau of Reclamation
Tonie van Dam	University of Utah
Tyler Knudsen	Utah Geological Survey
William Lund	Utah Geological Survey (retired)

Table 1. Earthquake sources (faults and fault segments) in the USGS *National Seismic Hazard Maps (NSHM)* or the UGS Hazus Utah fault database (UGS Open-File Report 631). These faults may warrant additional investigation (from 2015 UQFPWG meeting).

Utah Fault or Fault Segments	Included In		
	2023 NSHM	2015 NSHM	Utah Hazus
Beaver Basin intrabasin/eastern margin faults	Yes	--	Yes
Crater Bench/Drum Mountains fault zone	Yes	--	Yes
Crawford Mountains (west side)	Yes	--	Yes
Cricket Mountains fault (west side)	Yes	--	Yes
Fish Springs fault	Yes	--	Yes
House Range (west side) fault	Yes	--	Yes
Joes Valley fault zone	Yes	Yes	Yes
Little Valley faults	Yes	--	Yes
Malad segment, Wasatch fault zone	Yes	--	Yes
Mineral Mountains (west side) faults	Yes	--	Yes
North Promontory fault	Yes	Yes	Yes
Oquirrh fault zone	Yes	--	Yes
Oquirrh-Southern Oquirrh Mountains fault zone	Yes	Yes	Yes
Parowan Valley faults	--	--	Yes
Pavant/Tabernacle/Beaver Ridge/Meadow-Hatton/White Sage Flat faults	--	--	Yes
Porcupine Mountain faults	Yes	--	Yes
Scipio/Pavant Range/Maple Canyon/Red Canyon faults	Yes	--	Yes
Skull Valley faults (southern part)	--	--	Yes
Snake Valley faults	Yes	--	Yes
Snow Lake graben	--	--	Yes
Stansbury fault zone	Yes	Yes	Yes
Strawberry fault	Yes	Yes	Yes
Wah Mountains (south end)	Yes	--	Yes
West Cache fault, Wellsville section	Yes	Yes	Yes
West Bear Lake fault	Yes	--	Yes

Table 2. Status of proposed and published paleoseismic-related investigations based on priorities developed by the UQFPWG since 2005. If there are any missing publications, please send the reference to adamhiscock@utah.gov.

Study Type	Utah Fault or Fault Segment	UQFPWG Priorities		Investigation Status (as of 3/2024)
		2005	Additions	
Earthquake Timing	Nephi segment, Wasatch fault zone	1	2012 2017	UGS FTR Report, 05HQGR0098 (2005) USGS SI Map 2966 (2007) UGS Special Study 124 (2008) UGS FTR Report, G12AP20076 (2014) UGS Special Study 151 (2014) UGS Special Study 159 (2017) UGS FTR, G17AP00001 (2018)
	West Valley fault zone	2		
	Granger fault		2017	UGS Special Study 149 (2014)
	Taylorsville fault		2011 2017	UGS FTR, G15AP00117 (2017) UGS Special Study 169 (2022)
	Weber segment, Wasatch fault zone – most recent event and multiple events	3 4	2012 2017	UGS Miscellaneous Publication 05-8 (2006) UGS FTR, 07HQGR0093 (2007) UGS Special Study 130 (2009)
	Utah Lake faults and folds	5		
	Acquire earthquake timing information to investigate the relation of earthquakes to large earthquakes on the Provo segment		2015 2017	UUGG FTR Report, G08AP0016 (2014)
	Great Salt Lake fault zone	6		
	Rozelle section, East Great Salt Lake fault Carrington fault, Great Salt Lake fault zone		2007	UUGG FTR Report, G08AP0016 (2014) Janecke and Evans (2017)
	Collinston and Clarkston Mountain segments, Wasatch fault zone	7	--	UGS Special Study 121 (2007) UGS Open-File Report 638 (2015)
	Sevier and Toroweap faults	8	2016	UGS Special Study 122 (2008)
	Washington fault zone (includes Dutchman Draw fault)	9	--	UGS Open-File Report 583 (2011) UGS Miscellaneous Publication 15-6 (2015)
	Cedar City-Parowan monocline (removed 2016) and Paragonah fault	10	--	UGS Map 270 (2015) 2016 presentation file Paragonah fault, no activity
	Enoch graben	11	--	UGS Open-File Report 628 (2014)
	East Cache fault zone	12	2013	USU FTR Report, 07HQGR0079 (2012)
	Clarkston fault	13	--	UGS Special Study 98 (2000) UGS Special Study 121 (2007) UGS Open-File Report 638 (2015) UGS FTR, G17AP00001 (2018)

Study Type	Utah Fault or Fault Segment	UQFPWG Priorities		Investigation Status (as of 3/2024)
		2005	Additions	
Earthquake Timing	Wasatch Range back-valley faults (includes Morgan fault and Main Canyon fault)	14	--	UGS Miscellaneous Publication 11-2 (2011) UGS Miscellaneous Publication 10-5 (2010)
	Hurricane fault zone	15	--	UGS Special Study 119 (2007)
	Levan and Fayette segments, Wasatch fault zone	16	--	UGS Map 229 (2008) UGS Open-File Report 640 (2015) UGS FTR G17AP00071 (2019)
	Gunnison fault	17	--	No activity
	Scipio Valley faults	18	2017	No activity
	Faults beneath Bear Lake	19		No activity
	Eastern Bear Lake fault zone	20	--	No activity
	Provo segment, Wasatch fault zone			
	Penultimate event and long-term earthquake record	--	2007 2011 2012 2017	UGS MP 02-7 (2002) URS FTR Report, 02HQGR0109 (2011) UGS FTR Report, G13AC00165 (2015) Bennett and others, 2018 (BSSA)
	Fort Canyon fault, Traverse Mountains salient	--	2012	UVU FTR, G16AP00104 (2017)
	Brigham City segment, Wasatch fault zone			
	Most recent event and rupture extent	--	2007 2011	UGS Special Study 142, (2012)
	Salt Lake City segment, Wasatch fault zone	--	2009	
	Penrose Drive site	--	2012	UGS FTR Report, G10AP00068 (2010) UGS Special Study 149 (2014)
	Corner Canyon site	--	2012	UGS FTR Report, G14AP00057 (2014)
	Bear River fault zone	--	2007	AGU Abstracts: 2012 and 2013 Hecker and others, 2021 (Tectonophysics) USGS SI-Map 3430 (2019)
	Acquire new paleoseismic information to address data gaps for the five central segments of the Wasatch fault zone	--	2012	DuRoss and Hylland, 2015 (BSSA) DuRoss and others, 2018 (GRL)
	Topliff Hills fault	--	2016	Trenching by Toke, Bunds, and UVU students, ongoing
	Northern Oquirrh fault zone	--	2015 2017	Bunds and others, Poster 1 and Poster 2

Study Type	Utah Fault or Fault Segment	UQFPWG Priorities		Investigation Status (as of 3/2024)
		2005	Additions	
High Res. Mapping & Trench Site ID	Wasatch and West Valley fault zones	--	2014 2017	UGS Open-File Report 638 (2015) UGS Open-File Report 640 (2015) UGS FTR G17AP00001 (2018) UGS RI-280 (2020)
	Hansel Valley fault zone	--	2011	No activity
	East Bear Lake fault zone	--	2015 2017	UGS/IGS FTR Report G19AP00072/G19AP00073 (2021)
	East and West Cache fault zones	--	2015 2017	UGS FTR Report, G17AP00071 (2020) UGS RI Report (In Review)
	Hurricane fault zone	--	2014 2017	UGS/AZGS FTR Report G20AP007/G20AP008 (2021)
	Oquirrh fault zone	--	2015 2017 2018 2021	Bunds and others, Poster 1, Poster 2, and Poster 3, and presentation Bunds UGS/IGS FTR Report G19AP00072/G19AP00073 (2021)
	Southern Utah faults			
	Sevier/Toroweap faults		2018	UGS/AZGS FTR Report G20AP007/G20AP008 (2021)
	Mineral Mountains (west side) faults		2018	No activity
	Beaver Basin faults		2018	No activity
	Crater Bench/Drum Mountain faults		2018	No activity
	Scipio Valley faults		2018	No activity
	Little Valley faults		2018	No activity
	Paunsaugunt fault		2021	No activity
Salt Tectonics	Levan and Fayette segments of the Wasatch fault zone	--	2016	UGS FTR G17AP00071 (2019) UGS Open-File Report 640 (2015)
	Main Canyon fault Sevier detachment/Drum Mountains fault zone Bear River fault zone Spanish Valley (Moab area) Joes Valley fault zone Scipio Valley faults Gunnison fault	--	2016	Scipio Valley and Bear River lidar data collected in 2018
Other	Warm Springs fault/East Bench fault subsurface geometry and connection	--	2010	BSU FTR G15AP00054 (2015) BSU FTR G17AP00052 (2017)