



## 2022 UTAH EARTHQUAKE WORKING GROUP MEETINGS UTAH QUATERNARY FAULT PARAMETERS WORKING GROUP SUMMARY

Wednesday, March 2, 2022  
Virtual Meeting

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### WELCOME AND INTRODUCTION

Emily Kleber (Utah Geological Survey [UGS]) called the 2022 Utah Quaternary Fault Parameters Working Group (UQFPWG) meeting to order at 1:00 p.m. Mountain Standard Time (MST). This meeting was held online using the Zoom platform due to the ongoing COVID-19 pandemic. For the 2022 meeting, updates were given as short, 10-minute lightning talks on Quaternary fault issues in Utah.

### UQFPWG Purpose and Goals

- Serves as a committee to help set and coordinate Utah's earthquake-hazard research agenda.
- Reviews ongoing paleoseismic research in Utah and updates 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 future Utah Quaternary fault paleoseismic investigations.

### General Utah Earthquake Geology Updates – 10-Minute Lightning Talks

*Presentations available at UQFPWG Website:*

<https://geology.utah.gov/hazards/info/workshops/working-groups/q-faults/>

Emily Kleber – Utah Geological Survey

- Welcome and Introduction

Chris DuRoss – U.S. Geological Survey, Intermountain West Coordinator

- Earthquake Hazards Program – External Grants and 2023 Funding Announcement Updates

Alex Hatem – U.S. Geological Survey

- 2023 National Seismic Hazard Maps (NSHM) Update (no PDF of presentation available)

Nathan Toke – Utah Valley University

- Timpanogos and Provo Peak Massifs – New Fault Mapping

Ivan Wong – Lettis Consultants International

- Warm Springs Fault - East Bench Fault Stepover - New Research

Adam Hiscock – Utah Geological Survey

- Utah Geological Survey Quaternary Fault Mapping Update

## UQFPWG 2023 FAULT INVESTIGATION PRIORITIES FOR USGS IMW EXTERNAL GRANTS

The Working Group's list of highest priority fault investigations is largely the same from 2022, with special emphasis on bolded items, which were discussed in more detail in the working group meeting.

- Acquire new paleoseismic information for areas with ongoing or completed lidar fault mapping projects:
  - West Valley fault zone – Granger and Taylorsville faults – *UGS Funded in 2022*
  - 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 segments
  - Oquirrh fault zone
  - Sevier fault
- “Salvage paleoseismology” (i.e., earthquake timing investigations as rapid development is encroaching on un-modified paleoseismic trenching sites:
  - West Valley fault zone – Granger and Taylorsville faults
  - Cache Valley faults – East Cache fault zone and West Cache fault zone - *exposure in North Logan sampled. USU led.*
- Use recently acquired lidar data to more accurately map the traces of the:
  - Scipio Valley faults
  - Beaver Basin faults (partial coverage)
  - Hansel Valley faults
  - Paunsaugunt fault
  - Mineral Mountains west side faults - *some recon mapping done*
  - Stansbury fault zone - *Lidar mapping completed by UGS in 2021. Ongoing work by UVU.*
  - **Faults in the West Desert (Escalante Desert, Sevier Desert, Pilot Valley, Tintic Valley, Skull Valley) – *Some recon level lidar mapping completed by UGS as part of the U.S. Department of Energy INGENIOUS project, needs to be fully peer reviewed and added to Utah Quaternary Fault Database.***
- 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?**
- **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, and existing well data, seismic data**
    - **Warm Springs fault**
  - **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 - New methods or techniques to improve on this work?**

This does not include other priorities that have carried over from previous years. Those 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 updated the *Utah Quaternary Fault and Fold Database* in May 2020, incorporating new mapping and fault attributes. Ongoing updates are being reviewed by the UGS for Quaternary faults mapped in peer-reviewed publications from 2013 to 2020. Users of any Quaternary fault trace and related data acquired from the UGS or the Utah Automated Geographic Reference Center (AGRC) State Geographic Information Database (SGID) in the past are advised to use the updated database available from the AGRC 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. A web portal to view the Quaternary faults database is available at <https://geology.utah.gov/apps/hazards/>.

## **MEETING ATTENDANCE**

Registration for the virtual meeting was via a Google Form. Below is the list of people who signed up for the Zoom meeting. Specific attendance was not taken. \*Denotes meeting speaker.

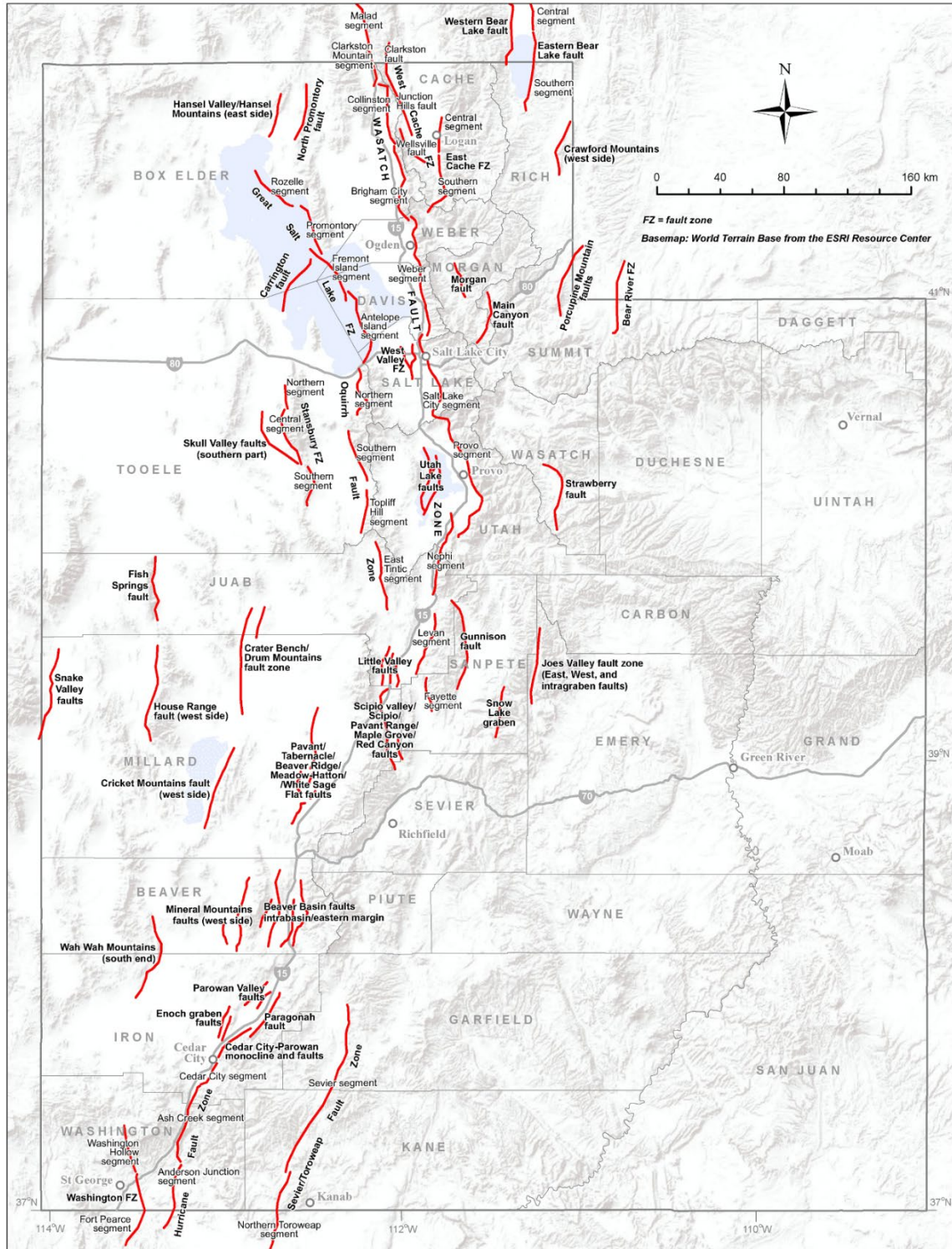
Ivan G Wong*	Lettis Consultants International
David Dinter	University of Utah
Fan-Chi Lin	University of Utah
Emily Kleber*	Utah Geological Survey
John Crofts	Utah Division of Emergency Management
Alex Hatem*	U.S. Geological Survey
Adam McKean	Utah Geological Survey
Patrick Emery	Gordon Geotechnical Engineering, Inc.
Jordan Culp	Gordon Geotechnical Engineering, Inc.
Ana Vargo	Natural Resources Conservation Service
Nathan Toke*	Utah Valley University
Adam Hiscock*	Utah Geological Survey
Chris DuRoss*	U.S. Geological Survey
Tyler Knudsen	Utah Geological Survey
Bob Carey	Utah Division of Emergency Management
Christian Hardwick	Utah Geological Survey
Mark Zellman	BGC Engineering

Michael Hylland	Utah Geological Survey
James C. Pechmann	Department of Geology and Geophysics, University of Utah
Nathan A Toke	Utah Valley University
Bob Smith	Department of Geology and Geophysics, University of Utah
Stefan Kirby	Utah Geological Survey
Chris Bloszies	Lettis Consultants International
Sofia Agopian	GeoStrata
Sean McGowan	Federal Emergency Management Agency, Region 8
Ben Erickson	Utah Geological Survey
Ron Harris	Brigham Young University
Steve Bowman	Utah Geological Survey

### **History of the Utah Quaternary Fault Parameters Working Group Since 2005**

The main goal of the UQFPWG is to characterize hazardous earthquake fault sources in Utah. The working group began in 2003 by developing consensus slip-rate (SR) and recurrence-interval (RI) data for all Utah trenched faults based on a comprehensive evaluation of paleoseismic-trenching data available at that time for Utah’s Quaternary faults, and where the data permitted, assigned consensus preferred RI and vertical SR estimates for the faults and/or fault sections reviewed. Trenching data were available for 33 of Utah’s known 211 Quaternary faults/fault sections and related structures.

In 2005, the UQFPWG developed a list of Quaternary faults and fault segments (Lund, 2005; table 2; figure 1) that the working group identified as requiring additional investigation to adequately characterize Utah’s earthquake hazard to a minimally acceptable level. Since then, the Working Group has added an additional 12 faults/fault segments to the list: five in 2007; one in 2009; one in 2010; four in 2011; three general recommendations regarding the five central segments of the Wasatch fault zone, fault zone mapping, and acquisition of high-resolution imagery in 2012, 2014, 2015, respectively; one in 2016, plus the relationship of salt tectonics to eight faults or fault zones; and slightly modified the existing list of highest priorities in 2017, 2018, 2019, and 2020. Table 1 lists the faults and fault segments (earthquake sources) incorporated in the USGS *National Seismic Hazard Maps*, and/or the UGS Hazus Utah fault database (updated through 2013, [UGS Open-File Report 631](#)). Faults not listed may need additional investigation.



**Figure 1.** Faults included in the UGS Hazus Utah fault database, except the Cedar City-Parowan monoclinal and faults removed in 2016 (see table 1; database updated through 2013, [UGS Open-File Report 631](#)).

**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.

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

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

Study Type	Utah Fault or Fault Segment	UQFPWG Priorities		Investigation Status (as of 3/2022)
		2005	Additions	
Earthquake Timing	Wasatch Range back-valley faults (includes Morgan fault and Main Canyon fault)	14	--	<a href="#">UGS Miscellaneous Publication 11-2 (2011)</a> <a href="#">UGS Miscellaneous Publication 10-5 (2010)</a>
	Hurricane fault zone	15	--	<a href="#">UGS Special Study 119 (2007)</a>
	Levan and Fayette segments, Wasatch fault zone	16	--	<a href="#">UGS Map 229 (2008)</a> <a href="#">UGS Open-File Report 640 (2015)</a> <a href="#">UGS FTR G17AP00071 (2019)</a>
	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	<a href="#">UGS Map 02-7 (2002)</a> <a href="#">URS FTR Report, 02HQGR0109 (2011)</a> <a href="#">UGS FTR Report, G13AC00165 (2015)</a> <a href="#">Bennett, and others, 2018 (BSSA)</a>
	Fort Canyon fault, Traverse Mountains salient	--	2012	<a href="#">UVU FTR, G16AP00104 (2017)</a>
	Brigham City segment, Wasatch fault zone			
	Most recent event and rupture extent	--	2007 2011	<a href="#">UGS Special Study 142, (2012)</a>
	Salt Lake City segment, Wasatch fault zone	--	2009	
	Penrose Drive site	--	2012	<a href="#">UGS FTR Report, G10AP00068 (2010)</a> <a href="#">UGS Special Study 149 (2014)</a>
	Corner Canyon site	--	2012	<a href="#">UGS FTR Report, G14AP00057 (2014)</a>
	Bear River fault zone	--	2007	AGU Abstracts: 2012 and 2013
	Acquire new paleoseismic information to address data gaps for the five central segments of the Wasatch fault zone	--	2012	<a href="#">DuRoss and Hylland, 2015 (BSSA)</a> <a href="#">DuRoss and others, 2018 (GRL)</a>
	Topliff Hills fault	--	2016	Trenching by Toke, Bunds, and UVU students, ongoing
	Northern Oquirrh fault zone	--	2015 2017	Bunds and others, <a href="#">Poster 1</a> and <a href="#">Poster 2</a>
	High Res. Mapping & Trench Site ID	Wasatch and West Valley fault zones	--	2014 2017
Hansel Valley fault zone		--	2011	No activity



Study Type	Utah Fault or Fault Segment	UQFPWG Priorities		Investigation Status (as of 3/2022)
		2005	Additions	
High Resolution Fault Mapping and Paleoseismic Trench Identification	East Bear Lake fault zone	--	2015 2017	<a href="#">UGS/IGS FTR Report G19AP00072/G19AP00073 (2021)</a>
	East and West Cache fault zones	--	2015 2017	<a href="#">UGS FTR Report, G17AP00071 (2020)</a>
	Hurricane fault zone	--	2014 2017	<a href="#">UGS/AZGS FTR Report G20AP007/G20AP008 (2021)</a>
	Oquirrh fault zone	--	2015 2017 2018 2021	Bunds and others, <a href="#">Poster 1</a> , <a href="#">Poster 2</a> , and <a href="#">Poster 3</a> , and <a href="#">presentation Bunds UGS/IGS FTR Report G19AP00072/G19AP00073 (2021)</a>
	Southern Utah faults			
	Sevier/Toroweap faults		2018	<a href="#">UGS/AZGS FTR Report G20AP007/G20AP008 (2021)</a>
	Mineral Mountains (west side) faults		2018	None
	Beaver Basin faults		2018	None
	Crater Bench/Drum Mountain faults		2018	None
	Scipio Valley faults		2018	None
	Little Valley faults		2018	None
	Paunsaugunt fault		2021	None
Salt Tectonics	Levan and Fayette segments of the Wasatch fault zone	--	2016	<a href="#">UGS FTR G17AP00071 (2019)</a> <a href="#">UGS Open-File Report 640 (2015)</a>
	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	<a href="#">BSU FTR G15AP00054 (2015)</a> <a href="#">BSU FTR G17AP00052 (2017)</a>