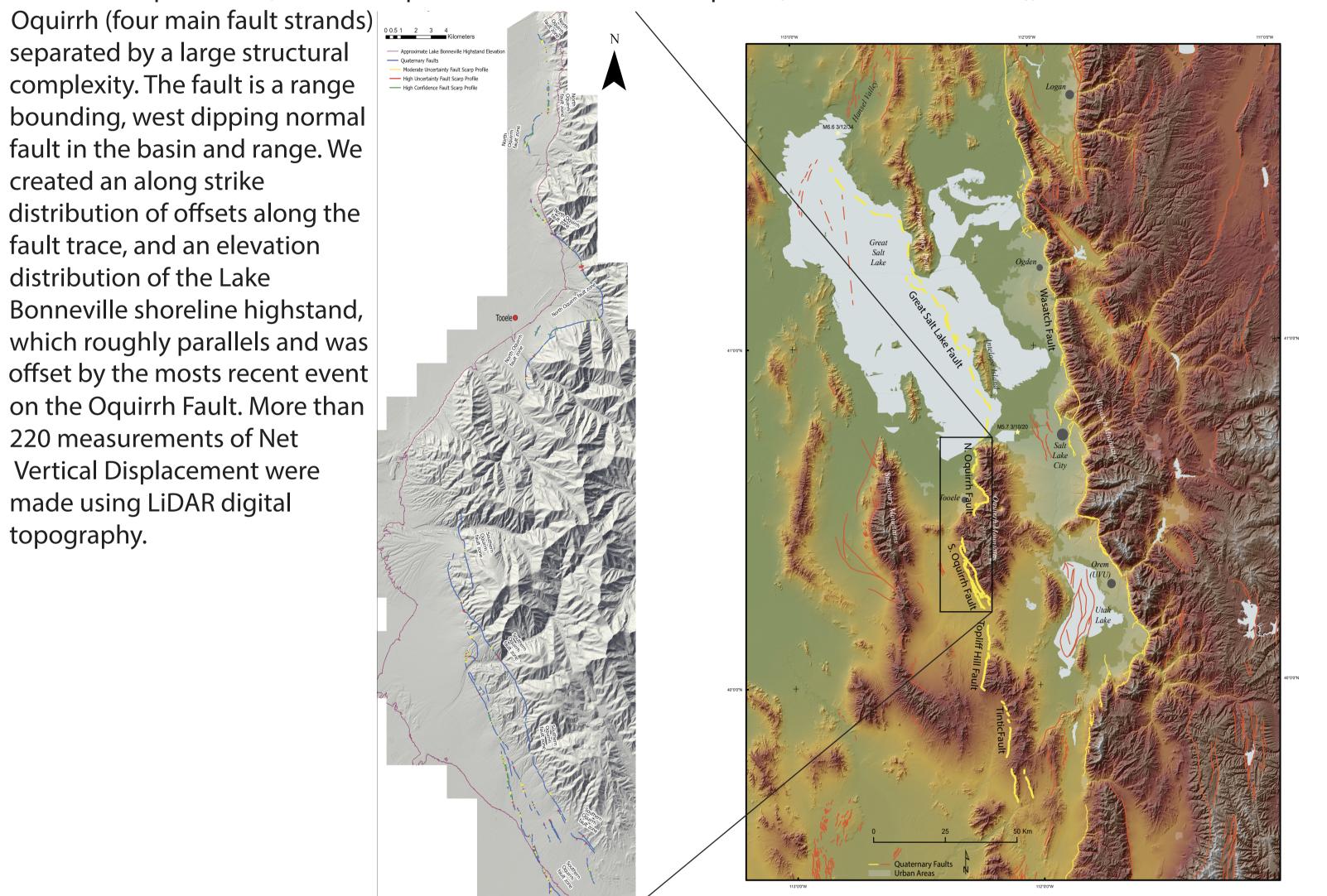


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### Background

uirrh fault, which comprises the ~27 km North Oquirrh (one main fault strand), and the ~25 km South

complexity. The fault is a range bounding, west dipping normal fault in the basin and range. We created an along strike distribution of offsets along the fault trace, and an elevation distribution of the Lake Bonneville shoreline highstand, which roughly parallels and was offset by the mosts recent event on the Oquirrh Fault. More than 20 measurements of Net Vertical Displacement were made using LiDAR digital topography.



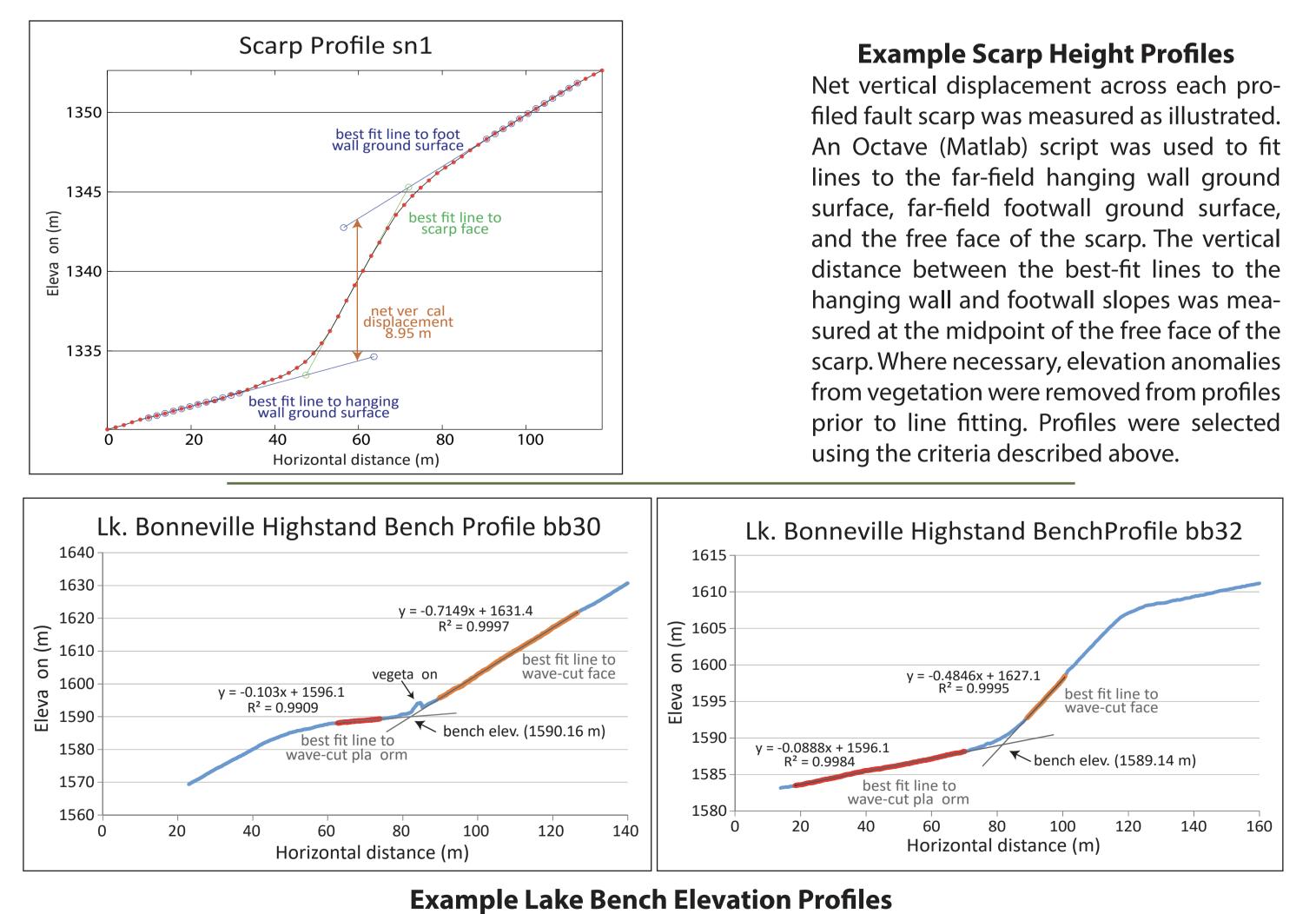
### **Profiling Methods**

Scarp heights and lake bench elevations were measured from profiles taken from DEMs at locations that met the following criteria:

Absence of indications of anthropogenic modification

Absence of indications of geomorphic modification such as fans, channels, nearby channels or gulleys/canyons. In some cases, visible minor shorelines provided evidence for the absence of more recent modification by geomorphic processes.

Presence (for shorelines) of a well-developed wave-cut platform and face. Presence (for fault scarps) of a well-developed scarp.



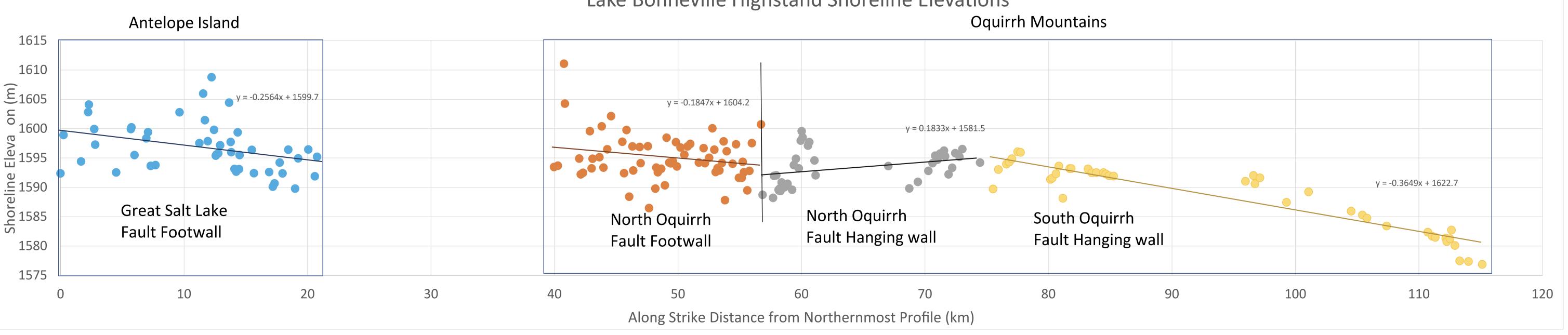
Fault displacement since the formation of the pluvial Lake Bonneville Highstand was measured using wave-cut shoreline platforms. For this study, elevation of wave-cut platform is defined and measured as the intersection of best-fit lines to the wave-cut platform and wave-cut face. An Octave (Matlab) script was used to fit lines to the two surfaces, as illustrated. In some cases elevation anomalies from plants were removed from the profile prior to line fit-

Fault offset measurement does not account for possible bench height variations due to isostatic rebound, wave dynamics, currents, etc.

## Goals:

- Methods:

- event.
- Results
- of the GSLF



# Insights into Segmentation and Surface Rupture History of the Oquirrh - Great Salt Lake Fault System, Utah, USA, from Fault Scarp Heights and Lake Bonneville Shoreline Elevations

## Key Points

 Investigate segmentation between Great Salt Lake Fault, North Oquirrh Fault, and South Oquirrh Fault in recent surface-rupturing earthquakes using fault scarp heights and elevations of Lake Bonneville shorelines. • Has the southern portion of the Great Salt Lake Fault co-ruptured with the Northern Oquirrh Fault in recent surface rupturing events?

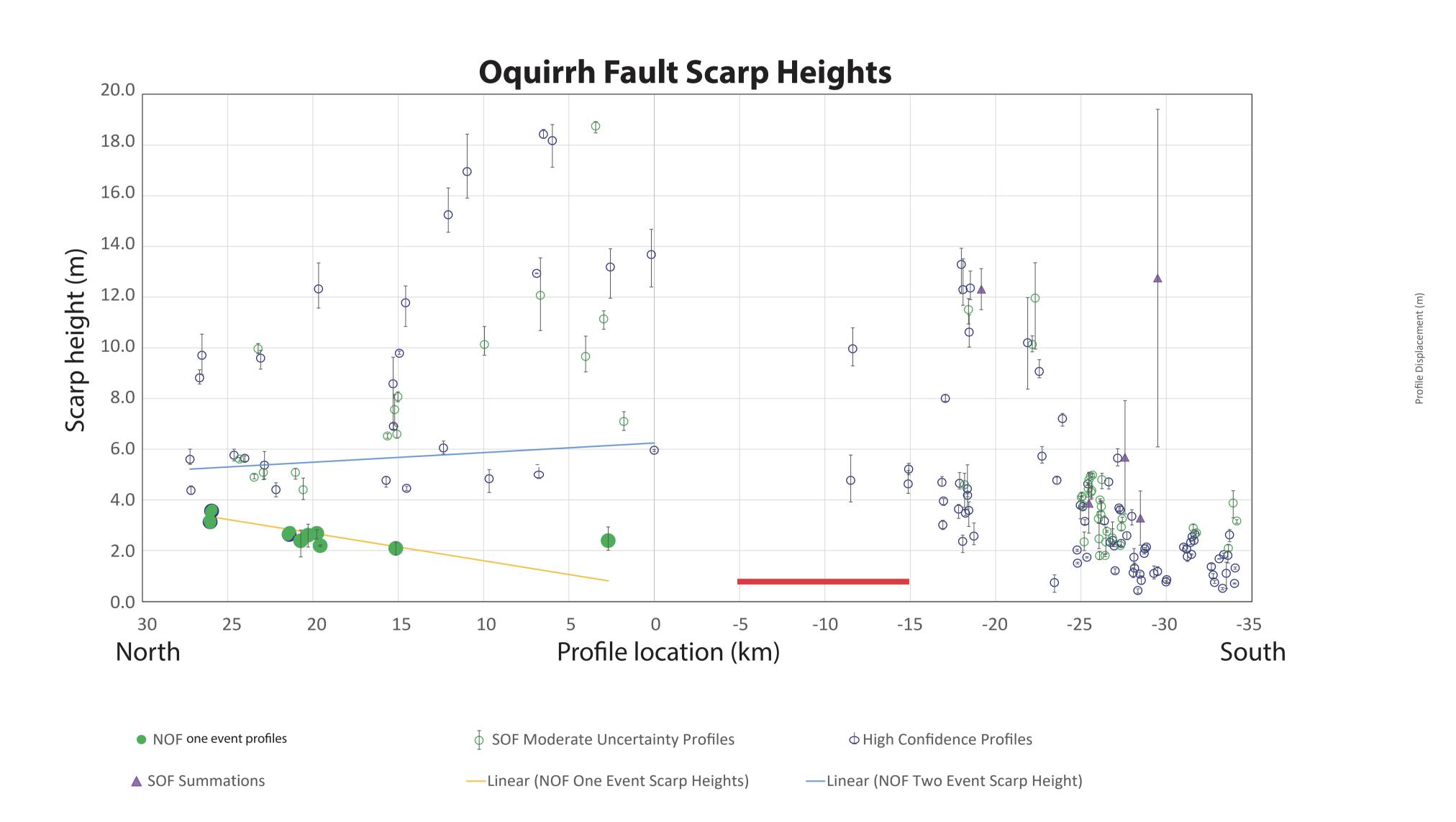
• Scarp height was measured at ~200 locations using profiles extracted from a digital elevation model (DEM), • Lake Bonneville shoreline elevations were measured at ~200 locations.

• The shoreline runs along the mountain front, parallel to the fault trace, and displaced by the most recent

• We anticipated seeing maximum displacement and scarp height near the center of the ruptured segment, tapering to lower heights and displacement near the segment ends.

 Southern Great Salt Lake may have co-ruptured with Northern Oquirrh Fault in MRE. • Scarp heights from MRE on Northern Oquirrh Fault monotonically increase northward to the southern end

•Elevations of Lake Bonneville shorelines in NOF footwall also increase towards the southern end of the GSLF.







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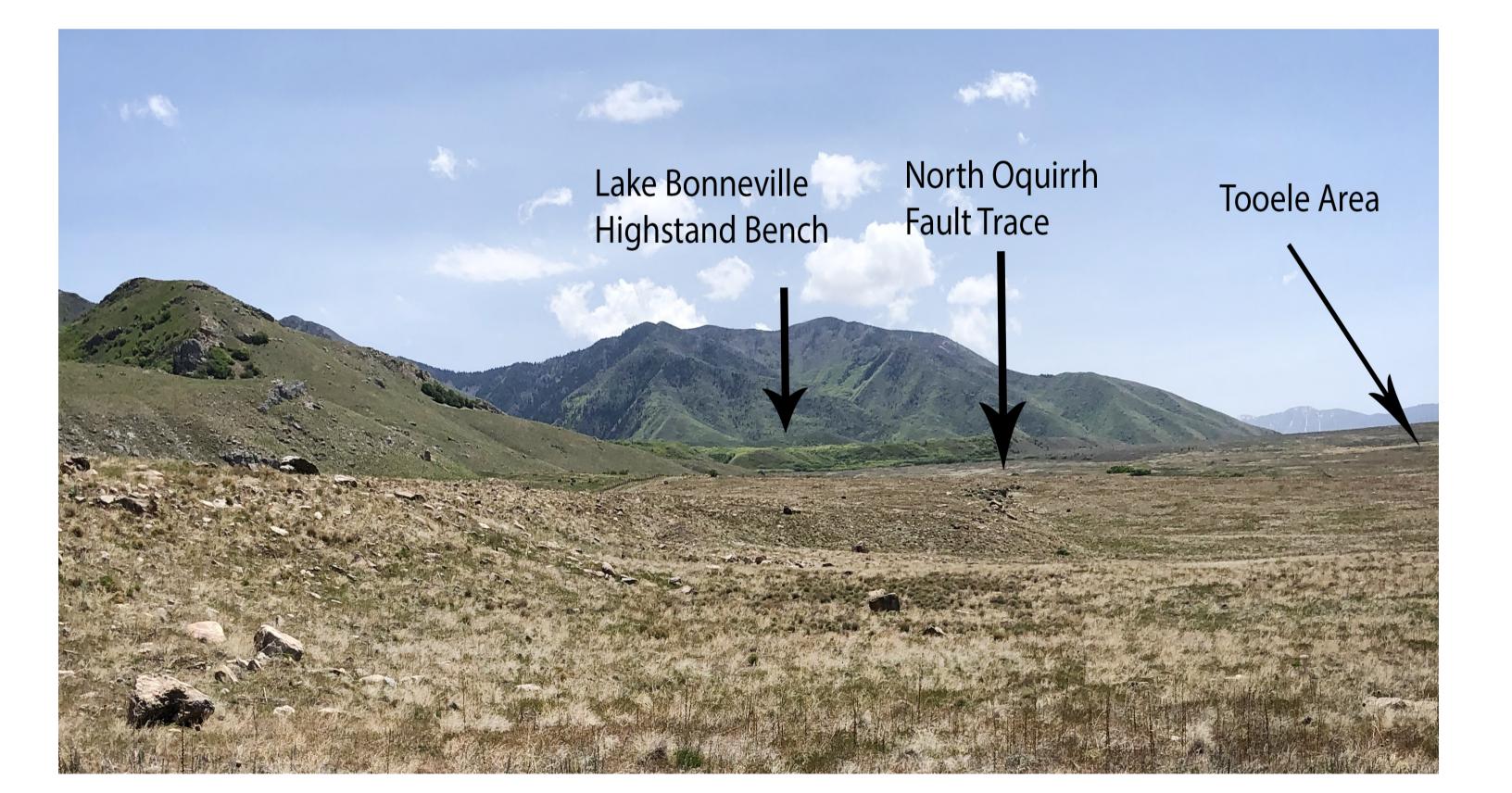
### Result

Je from 7 - 25 meters. The 2 and 3 event scarp height groups are evenly distributed t out the North Oquirrh Fault. The 1 event scarp heights are only grouped where the footwall is made up of Lake Bonneville sediment. Where the footwall is bedrock, 1 event scarp heights do not seem to be preserved. The 1 event scarp profiles have an increasing scarp offset height towards the northern end of the distribution The 2 event scarp profiles have a decreasing scarp offset height towards the northern end of the distribution. The trend is stronger in the 1 event scarp height group. A pooled T-test at 95% confidence showed that the trend on the 1 event scarp heights is statistically significant. The 2 event scarp height trend is only significant at 80% confidence

The offset distribution of the South Oquirrh Fault is much more complex because the South Oquirrh Fault is made up of four main strands. Offsets range from 0.5 meters to 15 meters. The north section of fault crosses through bedrock, and the southern section crosses through Lake Bonneville deposits. The southern part is where three main strands cluster. Summations of these clustered strands range from 2 meters to 46 meters. Distribution of Lake Bonneville shoreline elevations reflects a negative slope north to south. The distribution across Antelope island has a steeper trend than the distribution across the Oquirrh Mountains

### Conclusior

The data suggests that the most recent event on the North Oquirrh Fault may have included rupture on at least the southern part of the Great Salt Lake Fault, consistent with an estimated >40 km rupture length of the most recent event based on offset (Wells and Coppersmith, 1994, Olig et al., 2001). Lake Bonneville Shorelines in the North Oquirrh Fault footwall, which pre-date the most recent event and post-date the penultimate event, increase in elevation to the north supporting this hypothesis, although it is difficult to separate isostation rebound and tectonic effects on shoreline elevation. In contrast, preliminary results indicate that o ffset in the penultimate event may decrease towards the north end of the North Oquirrh Fault, suggestive of a different rupture distribution in that event.



### **Future Work:**

Does the South Oquirrh Fault rupture with the North Oquirrh Fault or Topliff Hills Fault to the south? Are there faults in the salient that provide links between the North and South Oquirrh Faults? The salient section of the Oquirrh Mountains has a different structure than the expected basin and range structure. How did it form? What is the age relationship between the Oquirrh Fault and the Bonneville, and sub - Bonneville shorelines?

### **References:**

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LiDAR data retrieved from raster.utah.gov; Utah Geospatial Resource Center Work by Andrew Fletcher as part of the 2015 UVU Geospatial Field Methods class contributed digital topographyy used in this project