LONG RECURRENCE RECORDS FROM THE WASATCH FAULT ZONE, UTAH

Grant No. 01HQGR0029

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Program Element II.5: Identify active faults, define their geometry, and determine the characteristics and dates of past earthquakes.

Our goal in FY2001 is twofold: (1) to date the remaining 13 radiocarbon samples collected in the 1999 "megatrench" across the Wasatch fault zone, and (2) to measure pedogenic clay in the various buried soils to compute estimated soil development times. These actions will improve the dating control on the seven paleoearthquakes identified in the trench walls.

INVESTIGATIONS

The megatrench was excavated from Sept. 13-17, 1999 across the two subparallel scarps that compose the main scarp of the WFZ; together these scarps have 18 m of vertical relief. During FY1999 we had sufficient funds to date only half of the 30 radiocarbon samples collected (Fig. 1, dates in black). In FY2001 we have dated the remaining samples (however, only 11 of the 15 had sufficient carbon for even AMS dating). These dates are shown in (Fig. 1, dates in red). In addition, we subcontracted Colorado State University to measure grain size and bulk density on 37 soil samples, collected in 5 vertical transects most of which included multiple buried soils.

RESULTS

Radiocarbon Dates: Most of the 11 C-14 dates came from the lower part of the stratigraphic section, which was composed of the recessional lacustrine sands deposited after the fall of lake Bonneville from the Bonneville Highstand to the Provo Shoreline (unit 5). Dates on the recessional sand range from 10.7 ka to 15.3 ka (2-sigma range of dendrochronological calendar time), compared to the widely-accepted ages of 15 ka for the Bonneville Flood and ca. 13.5 ka

for the abandonment of the Provo Shoreline.

There is an apparent age reversal between the uppermost part of the recessional lake sands (units 5a, 5cA), dated at 10.6-11.6 ka, and the overlying loess deposit (unit 6Bk), dated at 12.3-12.9 ka. At this time it is unknown which age is in error. Perhaps estimated times of soil development time based on pedogenic clay will shed some light on this reversal.

Unit 7, an early Holocene alluvial fan, yielded an age of 9.2-9.5 ka. This fan may have accumulated during the early part of the warm, dry Hypsithermal Interval.

Finally, three C-14 dates were obtained from the colluvial wedge and fissure fill sequence that post-dates the early Holocene fan. The age of 1.3-1.5 ka for the MRE colluvial wedge is consistent with previous studies, such as by Black et al. at Dry Creek, farther south on the Salt Lake City segment. However, the age of the penultimate event is younger than generally accepted, and the date of the antepenultimate event is close to the age usually cited for the penultimate event. These discrepancies will be addressed in the final report; however, it should be remembered that this trench was sited to optimize dating earthquakes older than 5 ka, rather than to re-hash the record of the four latest events which have been well-dated at other sites.

Unit No.	Strat. Unit	Lab. No.	Age (cal yr BP)
MRE	Colluvial wedge of Most Recent Event	B-158124	1330-1530
PE	Crack fill of Penultimate Event	B-158126	2160-2350
APE	Crack fill of Antepenultimate Event	B-158125	3060-3330
7	Early Holocene alluvial fan	B-158118	9250-9480
6Bk	Bk horizon developed on loess	B-158120	12,340-12,940
5a1	Recessional lacustrine sand	B-158128	10,580-11,070

5cA	A horizon on recessional lake sand	B-158121	10,660-11.130
5cA	A horizon on recessional lake sand	B-158117	11,220-11,560
5cAk	Ak horizon on recessional lake sand	B-158129	13,820-15,100
5cAC	AC horizon on recessional lake sand	B-158122	13,840-15,310
5cAC	AC horizon on recessional lake sand	B-158127	13,840-15,270

Soil Profile Clay Content and Age Estimates: We only received the laboratory analyses in mid October, so we have not yet calculated the mass of pedogenic clay in various horizons and soils, nor used those amounts to estimate soil development time. However, clay accumulation rates have previously been published for this area by Shroba, so those will provide a starting point for our age estimates.

NON-TECHNICAL SUMMARY

The Wasatch fault "megatrench" was excavated in Sept. 1999 across an 18 m-high double-scarp of the Salt Lake City segment of the Wasatch fault zone (WFZ), 1 km north of the mouth of Little Cottonwood Creek. The trench and accompanying auger hole exposed 26 m of vertical section, roughly 4 times that of the typical trench on the WFZ. Each of the two fault scarps transected were underlain by normal faults with 7-9.5 m of vertical displacement measured on the top of Bonneville-age lake beds (ca. 15,500 years old). Each fault was fronted by 3-4 colluvial wedges, indicating 3-4 post-Bonneville faulting events on each fault. The one surprise in the trench was the existence of a thick buried soil developed atop the lake beds and underlain by scarp-derived colluvium. This soil argues for a long period of fault inactivity between ca. 7-8,000 years ago and 15,500 years ago. That time span is roughly 4 times as long as the typical intervals between major earthquakes on this segment of the WFZ. The quiescent interval could be either an irregularity typical of the long-term behavior of the WFZ, or a response to the drying up of Lake Bonneville between 15,000 years ago and ca. 11,000 years ago, which relieved a huge weight on the downthrown fault block of the WFZ. At present we are interpreting the final 11 radiocarbon ages and independent age estimates based on soil profile development, to better date the 7 paleoearthquakes at this site and to quantify how irregular their interoccurrence times

can be.

INTRODUCTION