6. CONCLUSIONS

Seismic experiments were conducted across the Oquirrh fault with the goal of imaging the shape and location of colluvial wedges. The 3-D data consisted of 112,896 traces of which 85,450 traveltimes were picked and inverted to give the 3-D velocity structure of the Oquirrh fault over a volume of 142 ft x 30 ft x 60 ft. Reflectivity images from the 2-D seismic data provided information on the fault zone that was used, in conjunction with information from the 3-D tomogram, to estimate the magnitude of a prehistoric earthquake on the Oquirrh fault.

The 3-D tomogram presents a clear image of the colluvial wedge that agrees well with the shape and location of a colluvial wedge in a nearby trench. The thickness of the image is estimated to be 11.4 ft, which is within 17% of the estimate from trenching studies. The thickness estimate is also used to calculate a net vertical tectonic displacement of 6.7 ft, which is within 7% of the estimate from the trenching study. This displacement value provided an estimate of 6.8 for the earthquake magnitude, which is in good agreement with earthquake magnitude estimates based on surface rupture length, as well as with estimates based on displacement and surface rupture length.

I have demonstrated for the first time that seismic tomographic images can clearly reveal the shape and depth of colluvial wedges associated with normal-fault earthquakes. This result opens up the realistic possibility that 3-D seismic imaging, in conjunction with a drilling and dating survey, can complement some trench surveys that aim to estimate earthquake size and recurrence intervals. Moreover, the 3-D seismic survey can provide images over a wider area and a deeper extent than trench logs, and so might provide estimates of recurrence intervals over a greater span of time. The problem with seismic imaging is it has much less spatial resolution than a trench survey.

Future work should conduct 3-D seismic experiments with wider apertures in order to image multiple colluvial wedges to a depth of 40-50 ft. The distance between the colluvial wedges can then be used, in conjunction with known deposition rates, to estimate recurrence intervals of large earthquakes. In addition, coring through the colluvial wedges should be used to establish the feasibility of dating the origin time of colluvial wedges as well as establishing the relationships between lithology and velocity. The successful results of this thesis show that seismic imaging can be a complementary tool for paleoseismology studies and, in some cases, may provide a viable alternative to the intrusive task of fault trenching.

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