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Earthquakes, ecological change, and human modification: records in sediments of the Duwamish delta at Seattle, Washington

Elizabeth Davis
University Of Washington

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Earthquakes, ecological change, and human modification: records in sediments of the Duwamish delta at Seattle, Washington

Elizabeth Davis*, Helena Pfluger, Juliet Crider
University of Washington, Quaternary Research Center

*edav@uw.edu

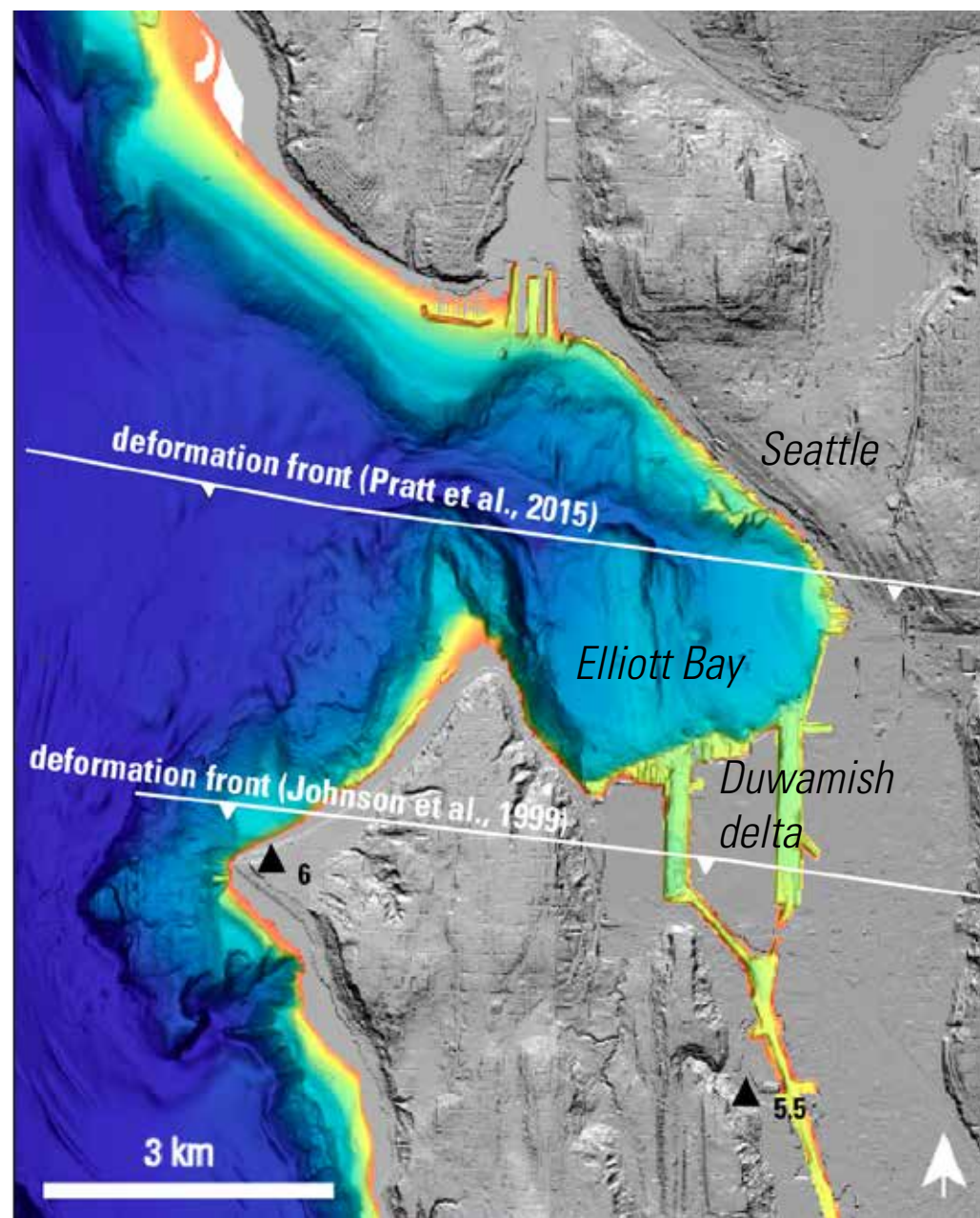


Figure 1. Topography (gray) and bathymetry (color) of downtown Seattle and Elliott Bay. On land, glacial drift forms a steep-sided ~140m high plain, modified by post-glacial processes and people. Waterways were mostly incised by subglacial meltwater, and now display various other features. Locations of strands of the Seattle Fault Zone vary; two interpretations are plotted in white lines. Black triangles show locations and amount in meters of uplift during an earthquake 900–930 CE. (data sources: King County Lidar 2016; NOAA BAG bathymetry 2010–2013)

Acknowledgments

We wish to acknowledge the people past and present who have witnessed deposition of these sediments, experienced earthquakes, and called this delta home, in particular the Duwamish Tribe and Coast Salish people.

The material in this poster is based upon work supported by the U.S. Geological Survey under Grant No. G19AP00036. Funding also came from the Quaternary Research Center at the University of Washington, Washington Space Grant, and the UW Department of Earth & Space Sciences. Special thanks to Brian Atwater, Emily Roland, Ginevra Moore, Dave Thoreson, Luke Maddux, and Kevin Pszczola.

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20th-century land modification sluiced hundreds of cubic meters of sediment into the Duwamish delta.

Comparing over 3000 soundings on a historical bathymetric map with modern bathymetry and new seismic reflection data may reveal areas of accumulation since 1875.



Figure 2. Regrading projects in Seattle sluiced over 200 thousand cubic meters of sediment into nearshore waterways. This photo shows hydraulic sluicing. Photo caption reads, “Lewis & Wiley, Inc; Jackson St. Regrade; Dec.28.08; Looking W. from 11th and King; #11752.” (Courtesy of City of Seattle Archives).

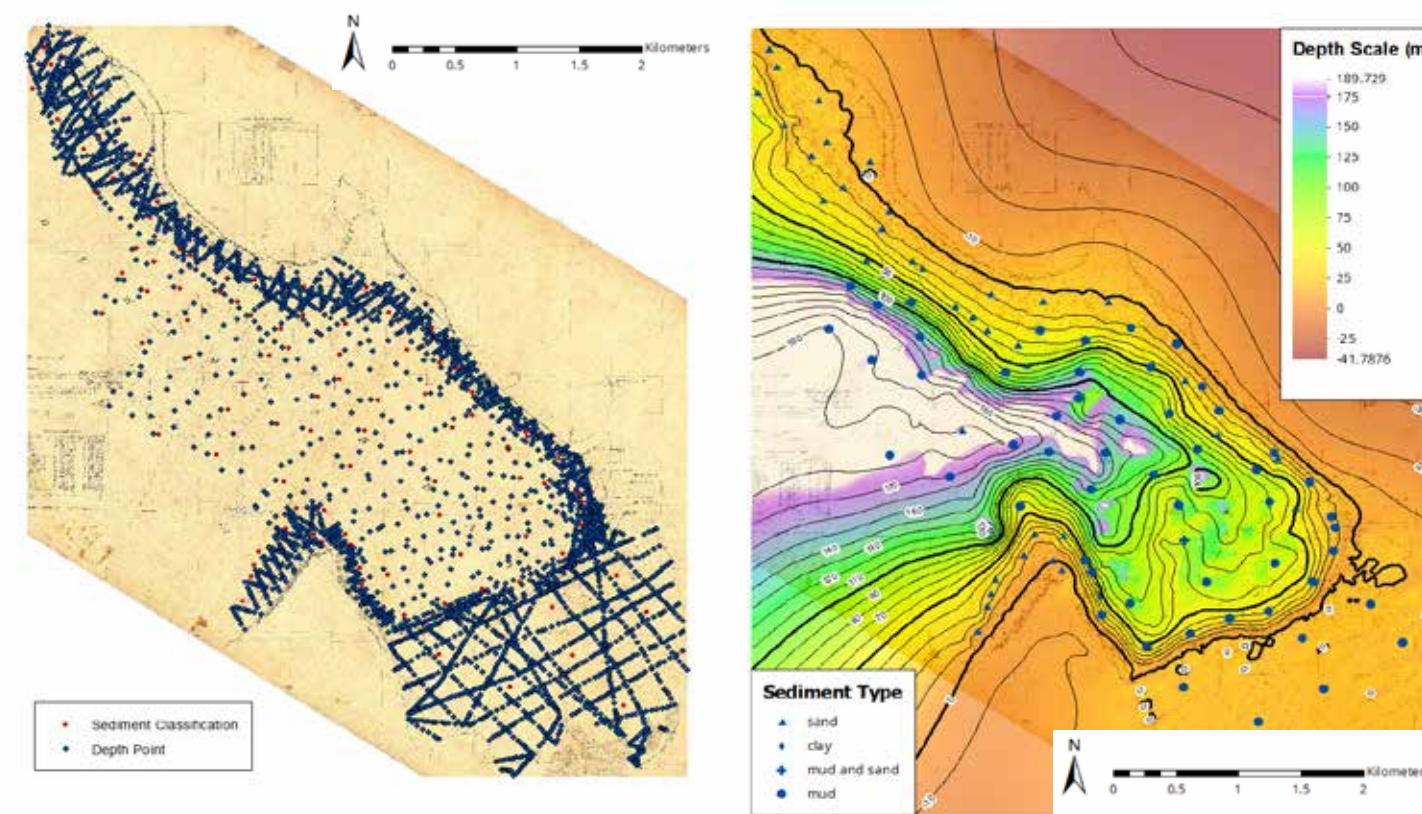


Figure 3. Left: 1875 bathymetric survey of Elliott Bay (Lawson, 1875), annotated with digitized depth points and sediment classifications. Right: Interpolated depth surface from depth points.

Earthquakes shook the Duwamish delta at least three times between 900 and 1900 CE.

★ 900–930 CE
M ~7.5 earthquake,
Seattle Fault Zone
uplifted Duwamish delta
at least 5 m
(Bucknam et al., 1992; ten Brink et al., 2006)

★ 1000–1130 CE
evidenced by liquefaction
in the former Duwamish
tidal marsh

★ after 1200 CE
evidenced by liquefaction
in the former Duwamish
tidal marsh

Ecological change accompanied earthquakes and land modification.

The 900–930 earthquake lifted land in the Duwamish delta; this uplift may be represented by a forested valley-bottom terrace (gold highlights) mapped in 1875. New 14C ages indicate the Duwamish tidal marsh established within 100 years of the uplift.

