LATE HOLOCENE EARTHQUAKES ON SCARPS ALONG THE LITTLE RIVER, LAKE CREEK-BOUNDARY CREEK FAULT, OLYMPIC PENINSULA

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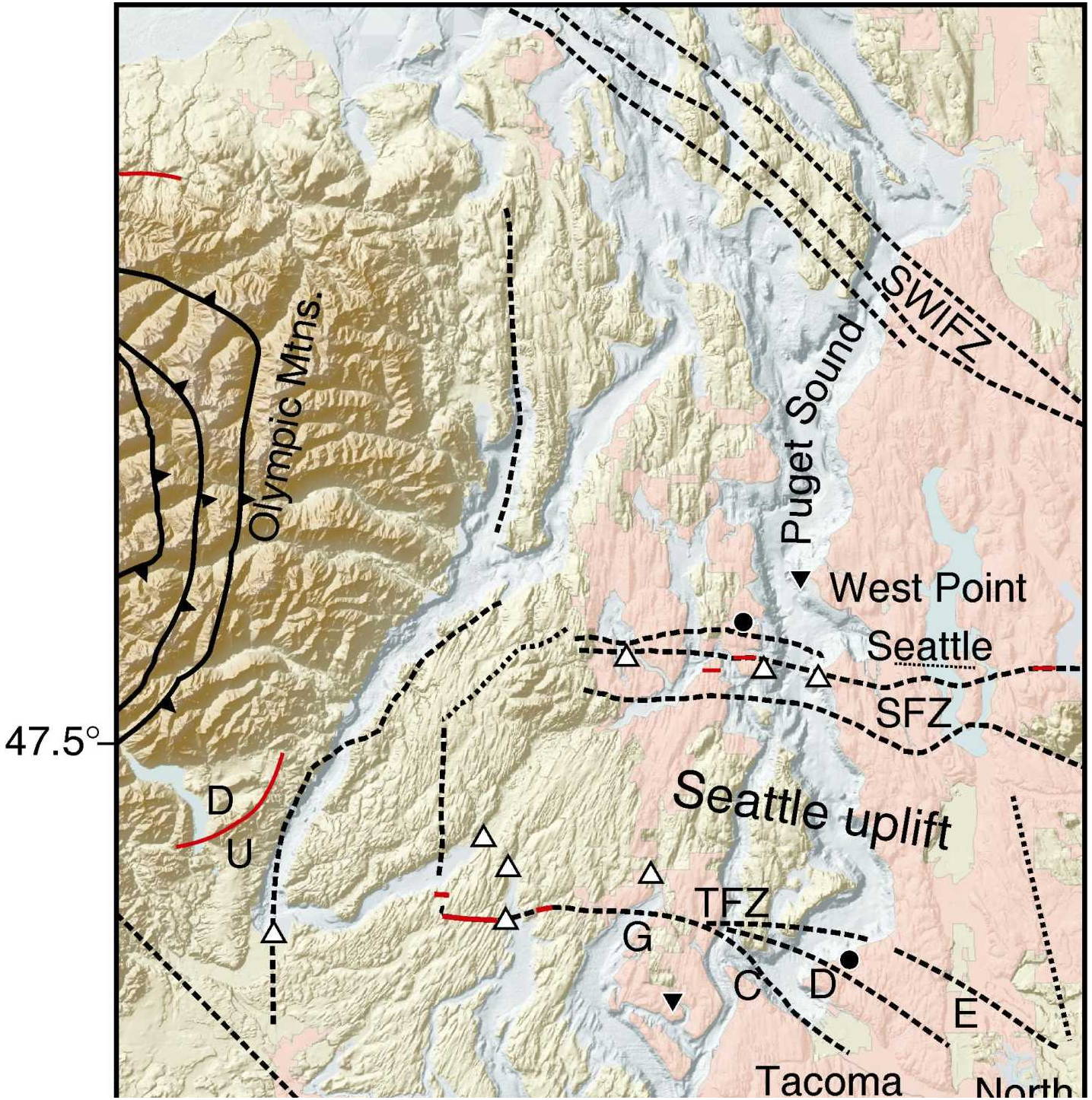
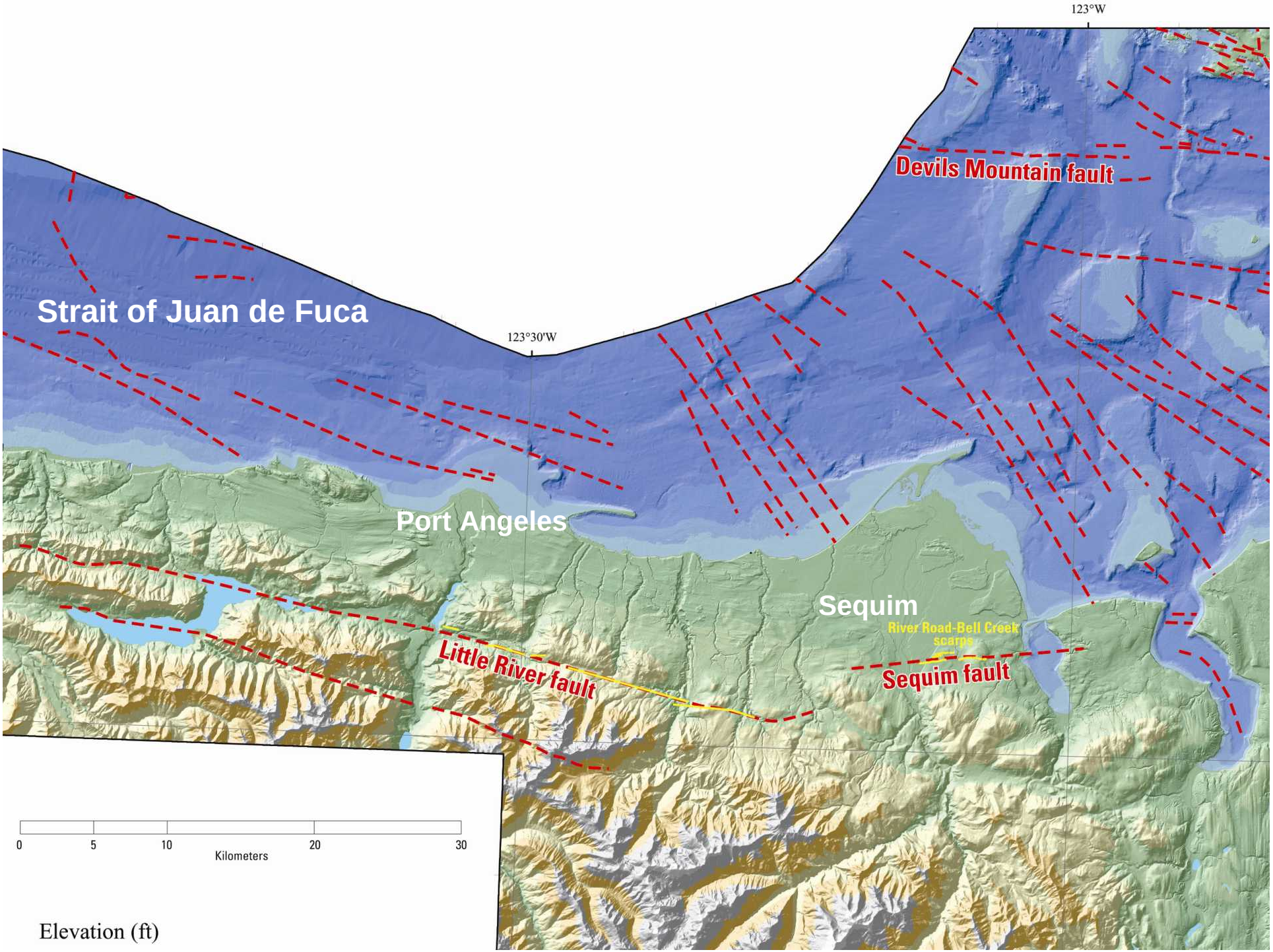
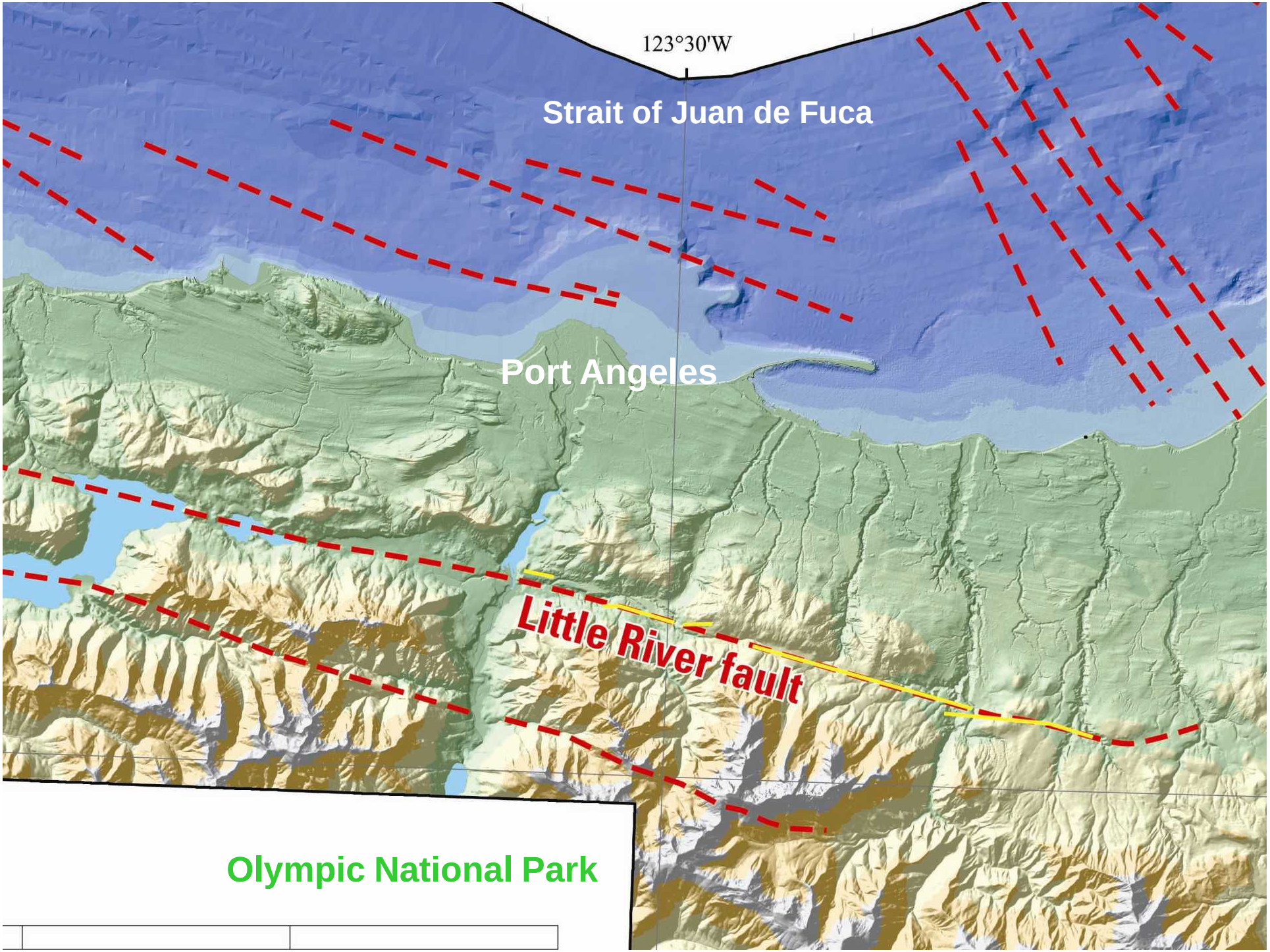

Olympic Mtns.
Puget Sound
SWIFZ
West Point
Seattle
SFZ
47.5°
D
U
Seattle uplift
TFZ
G
C
D
E
Tacoma
North


123°W
123°30'W
Strait of Juan de Fuca
Devils Mountain fault
Port Angeles
Sequim
River Road-Bell Creek scarps
Little River fault
Sequim fault
0
5
10
20
30
Kilometers
Elevation (ft)


123°30'W
Strait of Juan de Fuca
Port Angeles
Little River fault
Olympic National Park


Little River Valley

Little River scarps

Distinct on LiDAR but pretty hard to find in the woods

Typically 0.5-1.0 m high, straight, and discontinuous

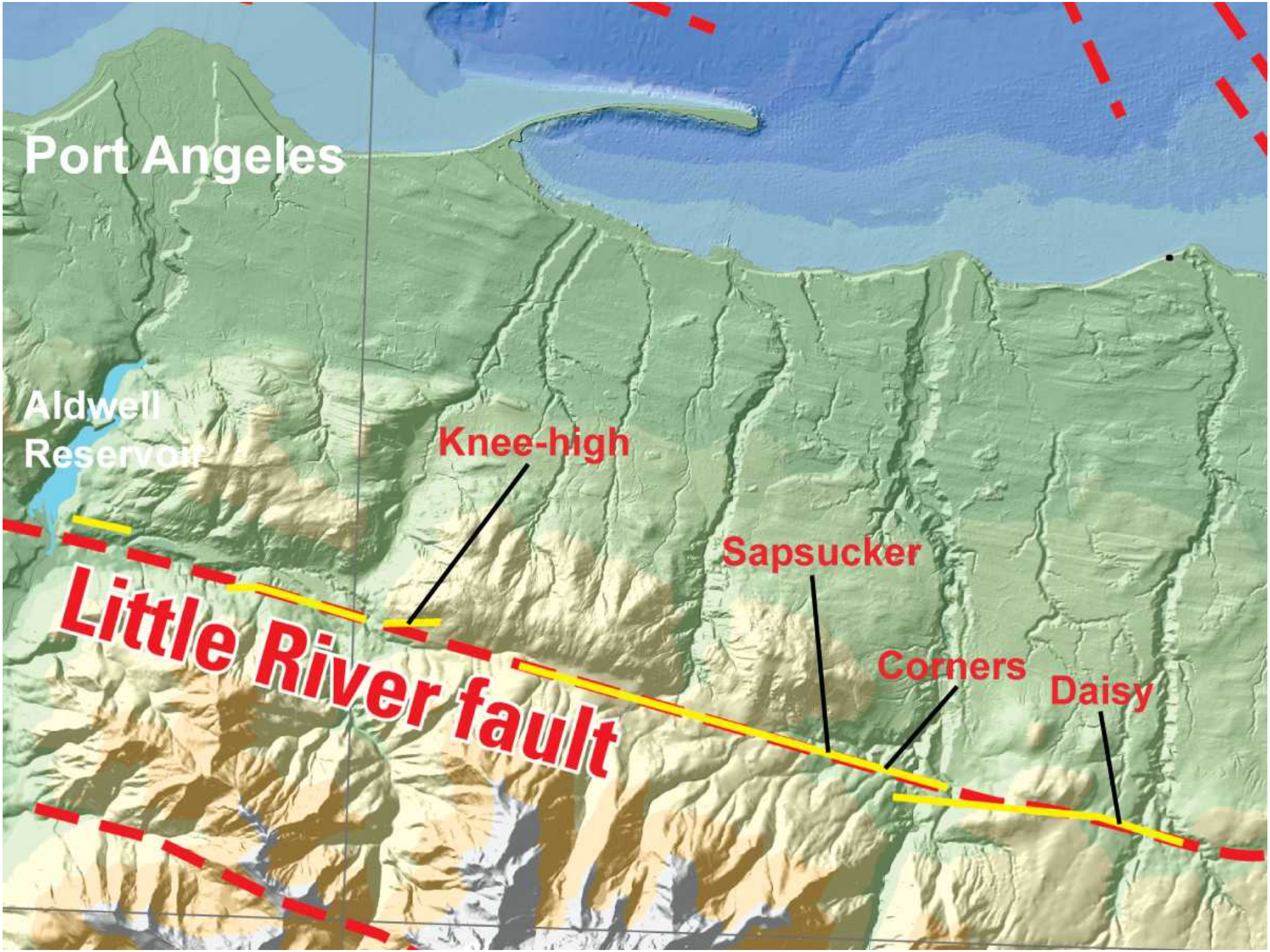
Most scarps probably record folding rather than surface faulting

Length of mapped late Holocene scarps:

certain – 15 km
probable – 24 km
possible – 35 km

Five trenches at four sites 1.5 to 14 km apart

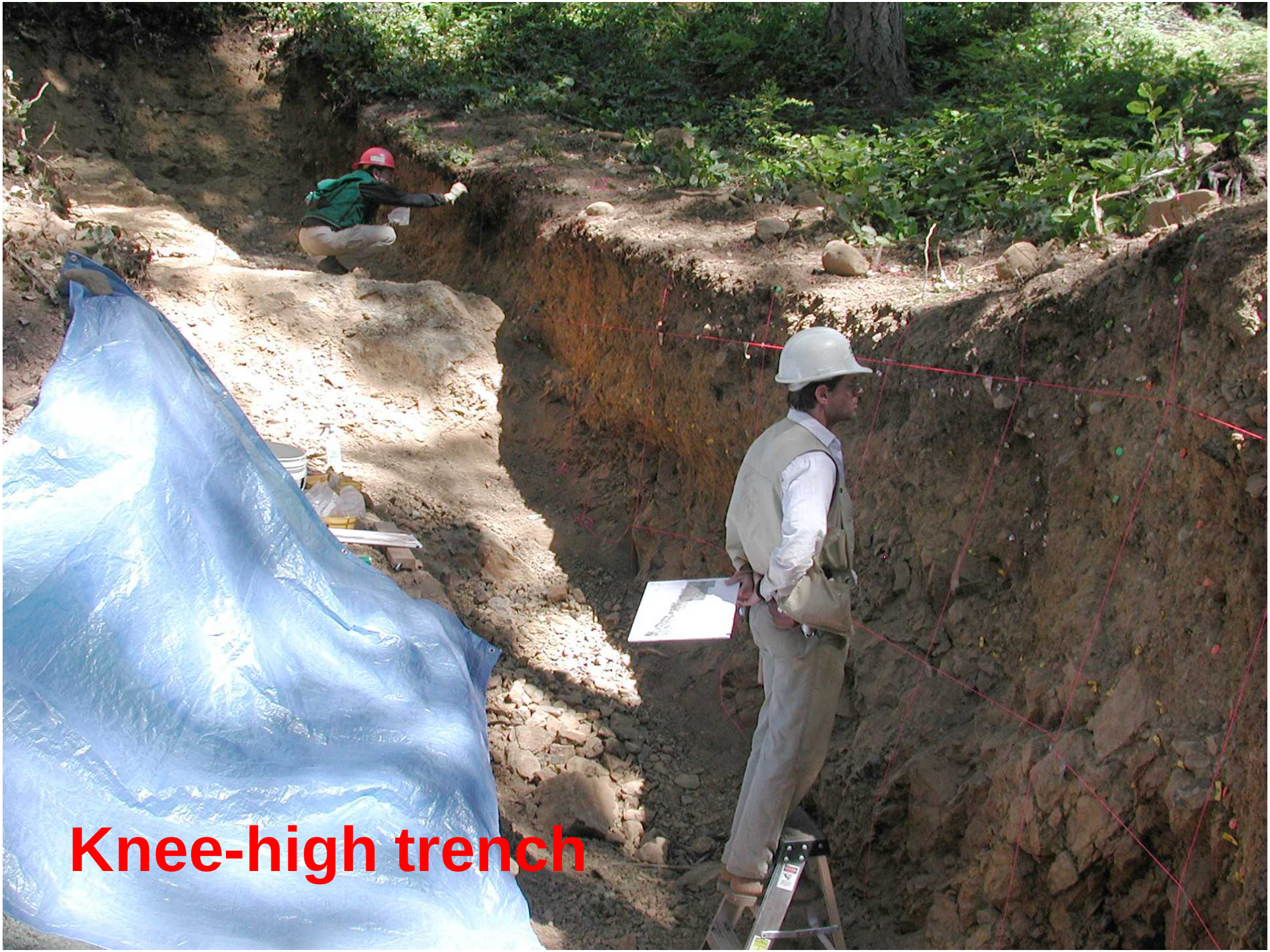

Scarp near Aldwell Reservoir


Port Angeles
Aldwell
Reservoir
Knee-high
Sapsucker
Little River fault
Corners
Daisy


Corners trench site

Corners trench

MiniCorners trench


Knee-high trench


Sapsucker trench site

Digging Sapsucker trench


Logging Sapsucker trench


Daisy trench

Vertical Displacement

Trench	Surface	Stratigraphic
Late Holocene		
Corners	1.3 m	0.8 m
MiniCorners	0.8 m	1.2 m
Net across Corners graben (in two earthquakes)	0.5 m	0.4 m
Sapsucker	1.1 m?	faulting 0.9 m folding ~2 m
Daisy	0.7 m?	faulting 0.8 m folding ~2 m
Late Quaternary		
Knee-high	1.7 m?	>0.8 m

Uncertain evidence for lateral fault slip

Straight scarps with broad, gentle slopes typical of surface folding above oblique strike-slip faults

Upward splaying (flower structure) fault patterns in Corners, Sapsucker, and Daisy trenches

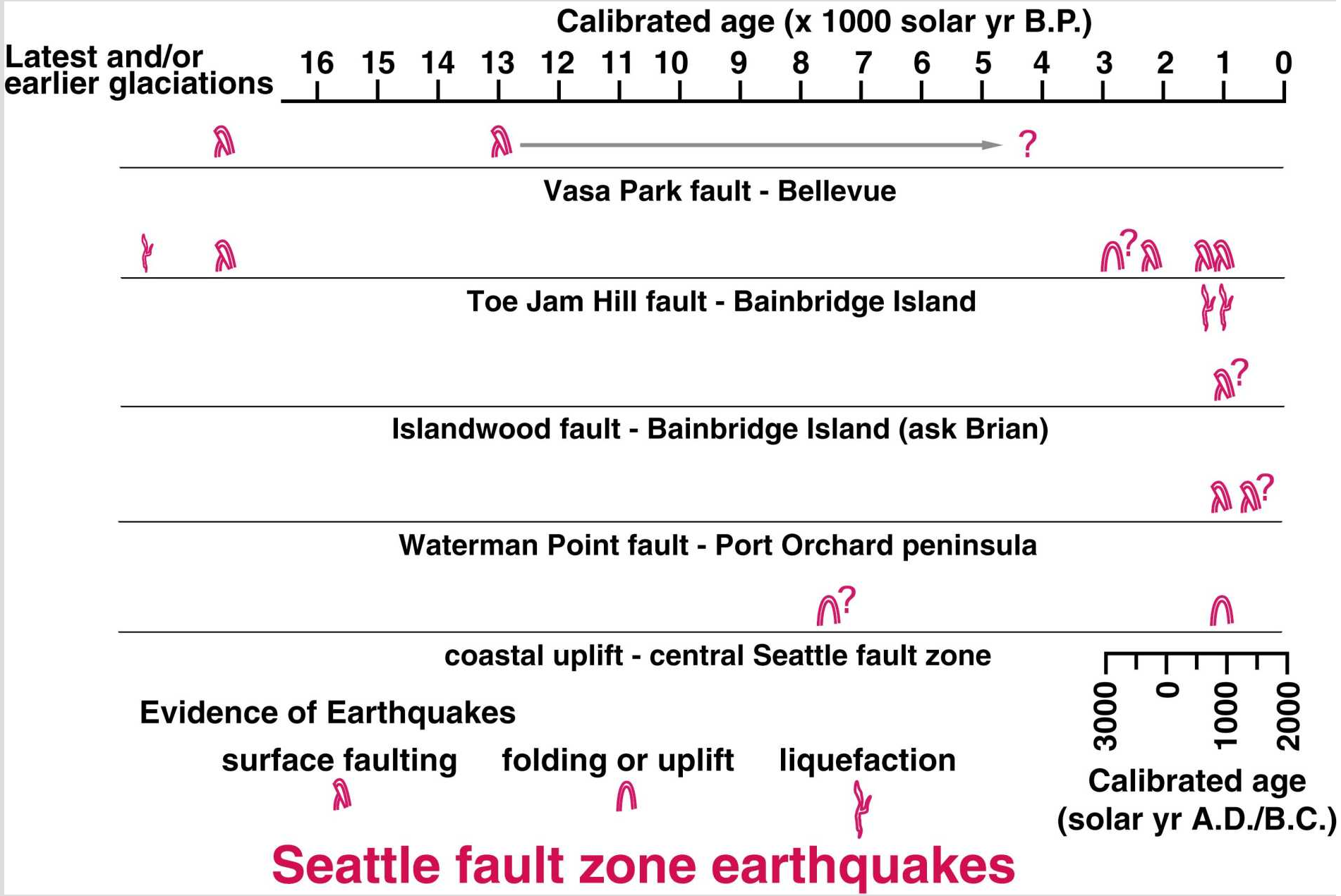
Small displacements of contacts with inconsistent sense of slip across faults and fissures in trench walls

Low-angle plunge of bedrock fault grooves in Knee-high trench suggest 1:4 oblique left-lateral slip

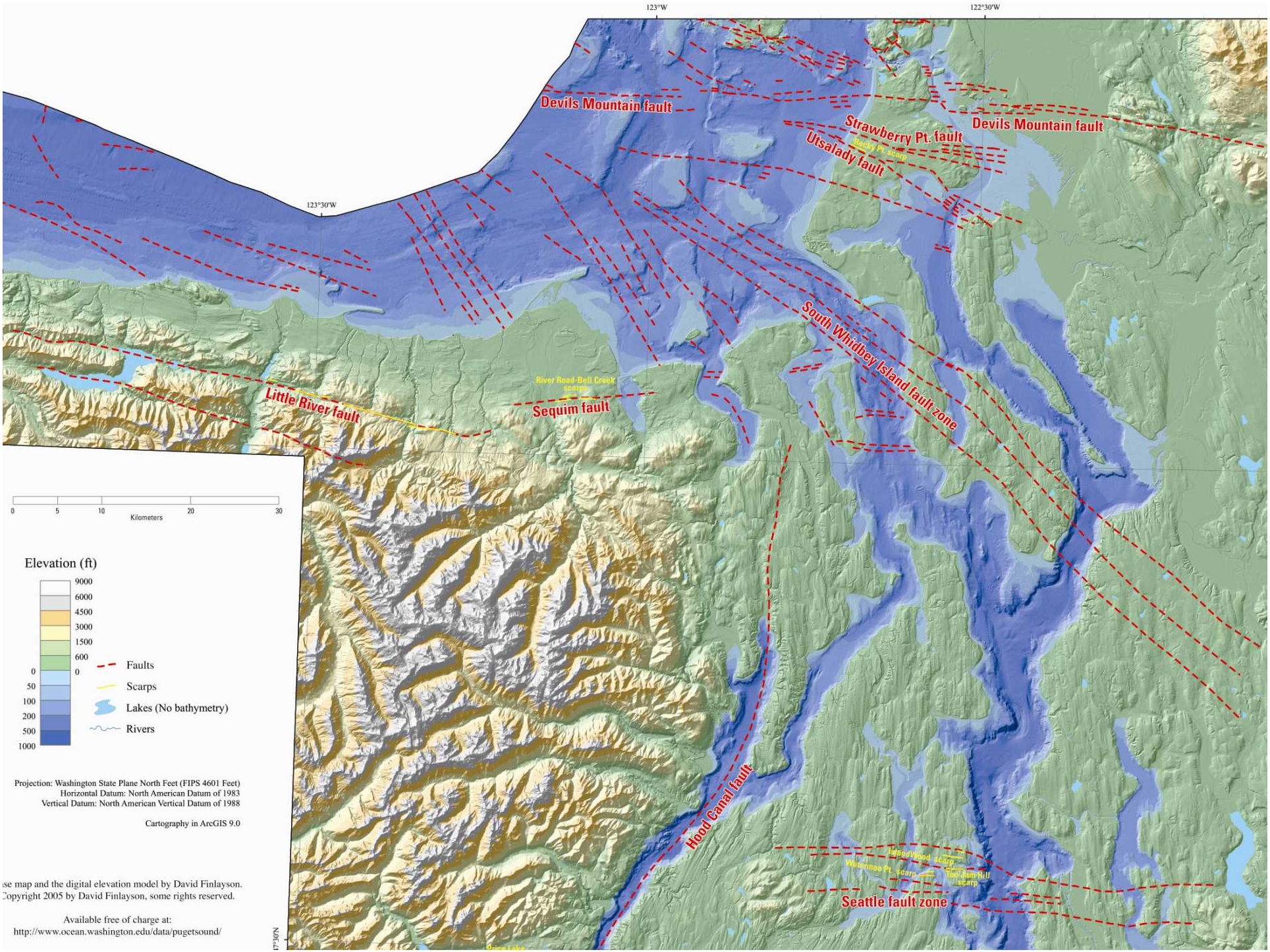
Two other low-angle grooves on small faults in till in Daisy trench suggest both left-lateral and right-lateral slip

Earthquake Timing

Trench	Surface faulting/folding earthquakes
Corners	1 earthquake <3000 yr BP
MiniCorners	1st earthquake 2000-600 yr BP 2nd earthquake >600 yr BP?
Sapsucker	1 earthquake (9 ^{14}C ages pending)
Daisy	1 earthquake (7 ^{14}C ages pending)



Seattle fault zone earthquakes


123°W
122°30'W
123°30'W
Devils Mountain fault
Strawberry Pt. fault
Utsalady fault
Rocky Pt. scarp
Devils Mountain fault
South Whidbey Island fault zone
River Road-Bell Creek scarps
Little River fault
Sequim fault
Hood Canal fault
Island/Wood Mtn. scarp
Whidbey Pt. scarps
Top Jam Hill scarp
Seattle fault zone
0 5 10 20 30
Kilometers
Elevation (ft)
9000
6000
4500
3000
1500
600
0
0
50
100
200
500
1000
Faults
Scarps
Lakes (No bathymetry)
Rivers
Projection: Washington State Plane North Feet (FIPS 4601 Feet)
Horizontal Datum: North American Datum of 1983
Vertical Datum: North American Vertical Datum of 1988
Cartography in ArcGIS 9.0
se map and the digital elevation model by David Finlayson.
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http://www.ocean.washington.edu/data/pugetsound/