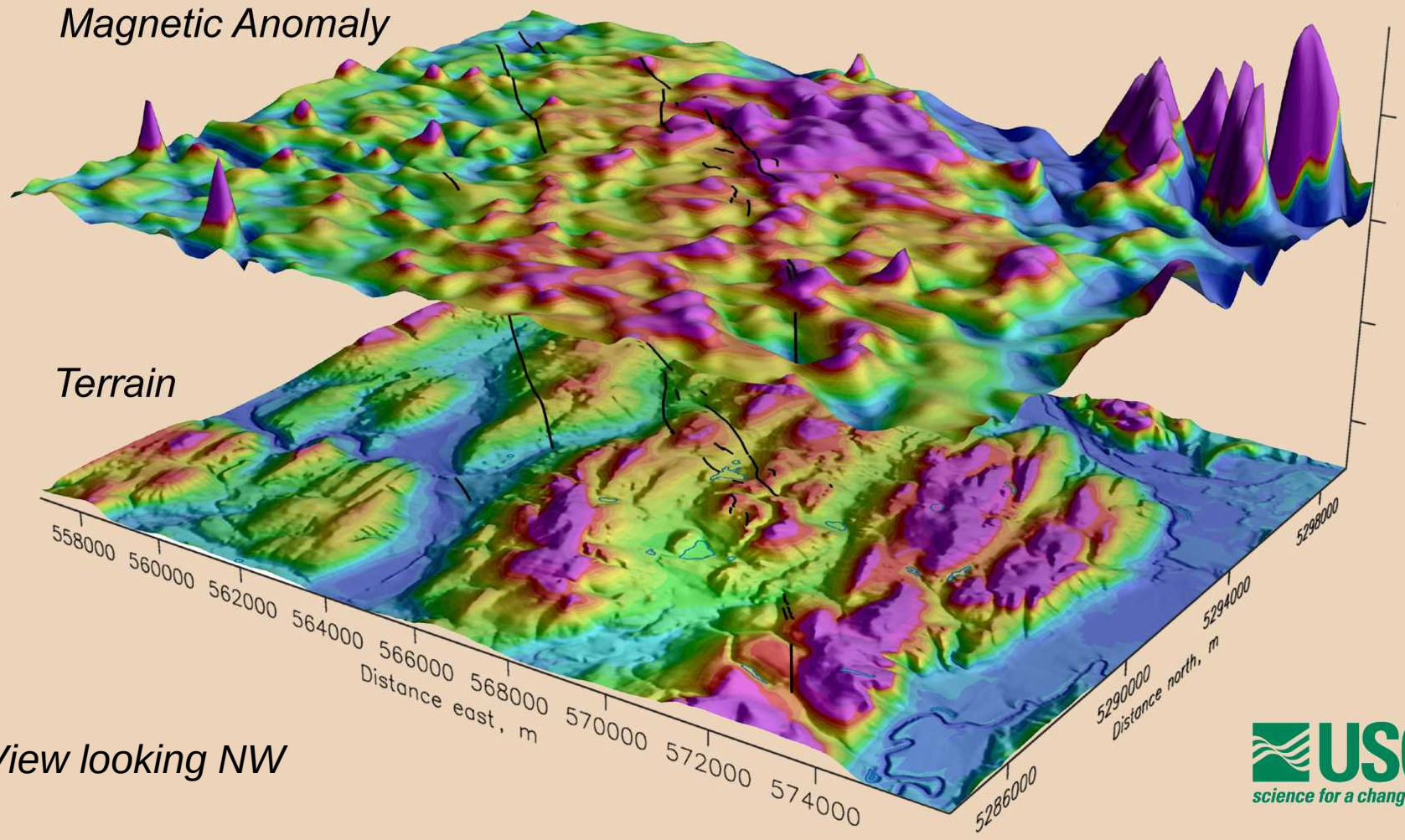
Findings on the southern Whidbey Island fault zone from aeromagnetic anomalies, lidar surveys, and trenching

Presentation by Rick Blakely and Brian Sherrod, with help from many others



View looking NW

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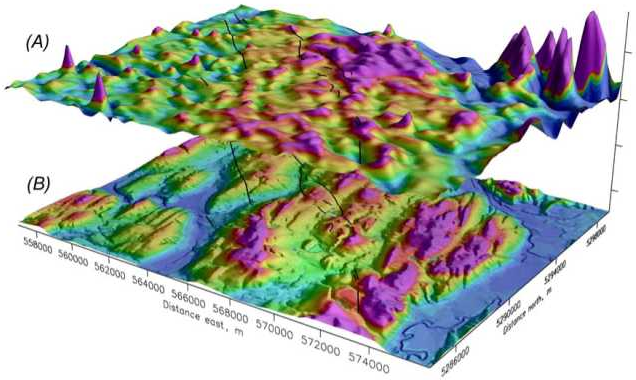
U.S. GEOLOGICAL SURVEY

THE COTTAGE LAKE AEROMAGNETIC LINEAMENT: A POSSIBLE ONSHORE EXTENSION OF THE SOUTHERN WHIDBEY ISLAND FAULT, WASHINGTON

By Richard J. Blakely[1], Brian L. Sherrod[2], Ray E. Wells[1], Craig S. Weaver[2], David H. McCormack[3], Kathy G. Troost[4], and Ralph A. Haugerud[2]

Open-File Report 2004-1204

2004



[1] U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025
[2] U.S. Geological Survey, Box 351310, University of Washington, Seattle, WA 98195
[3] Aspect Consulting, 811 First Avenue, Suite 480, Seattle, WA 98104
[4] University of Washington, Department of Earth and Space Sciences, Box 351310, Seattle, WA 98195

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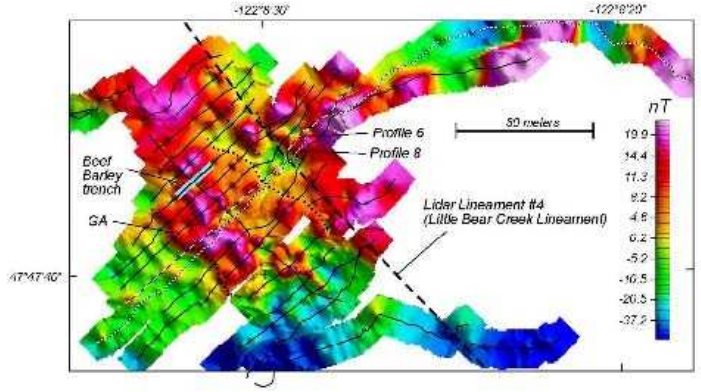
HOLOCENE FAULT SCARPS AND SHALLOW MAGNETIC ANOMALIES ALONG THE SOUTHERN WHIDBEY ISLAND FAULT ZONE NEAR WOODINVILLE, WASHINGTON

By Brian L. Sherrod, Richard J. Blakely, Craig Weaver, Harvey Kelsey, Elizabeth Barnett, and Ray Wells

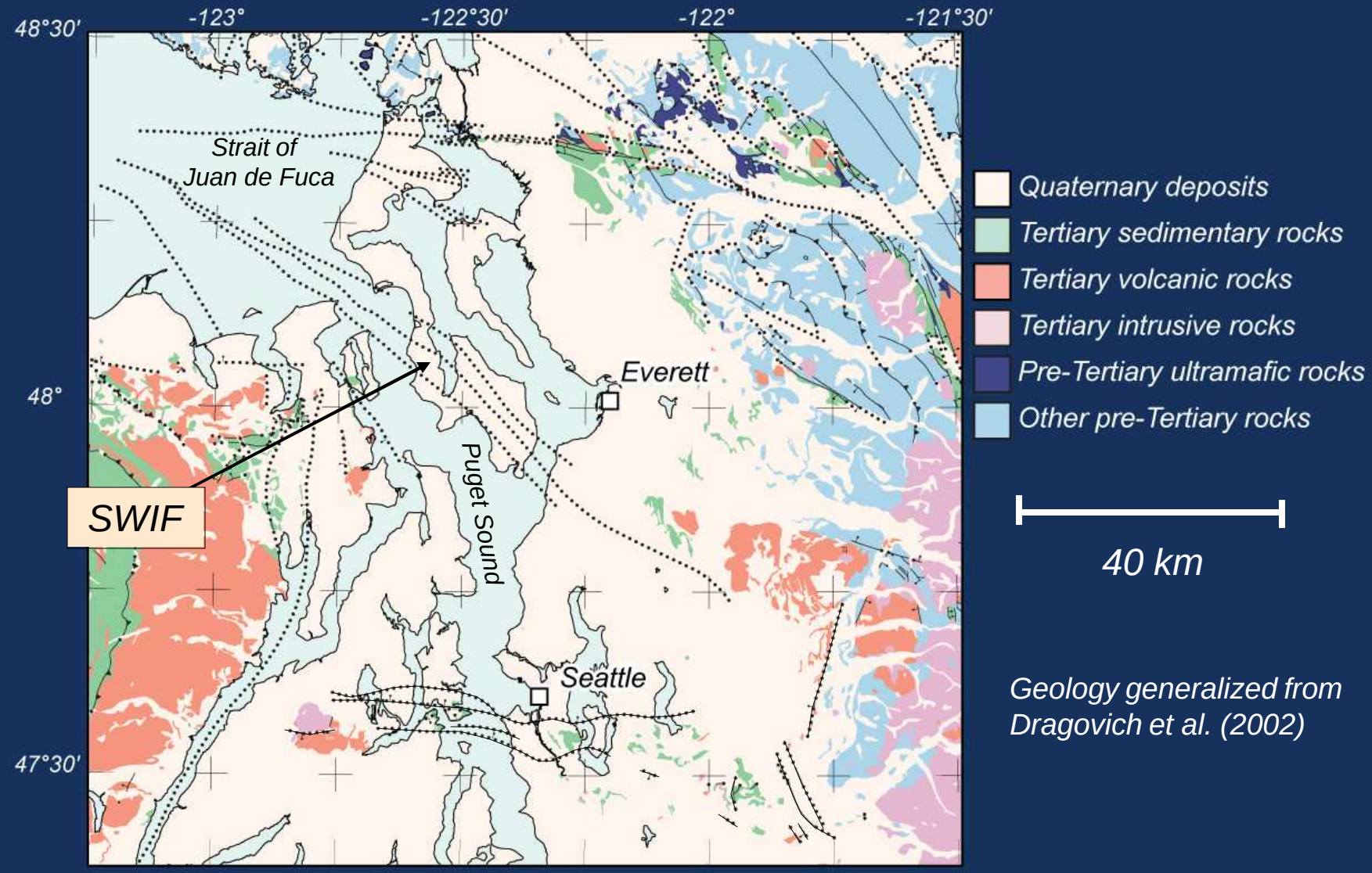


Open-File Report 2005-1136
March 2005

U.S. Department of the Interior
U.S. Geological Survey

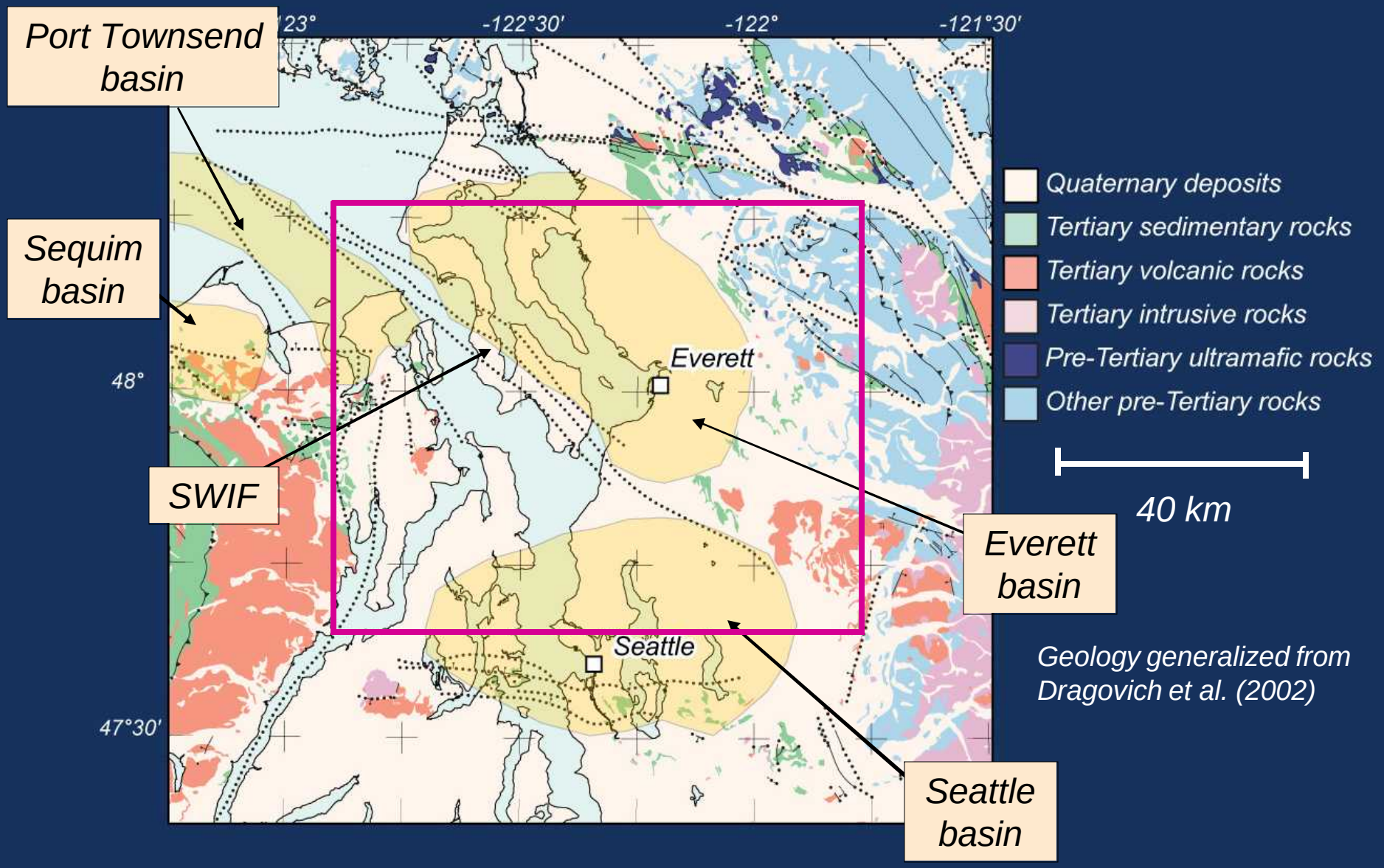
http://pubs.usgs.gov/of/2005/1136

The southern Whidbey Island fault extends 90 km, from Vancouver Island to the Washington mainland. How active is it, and where does it go onshore?

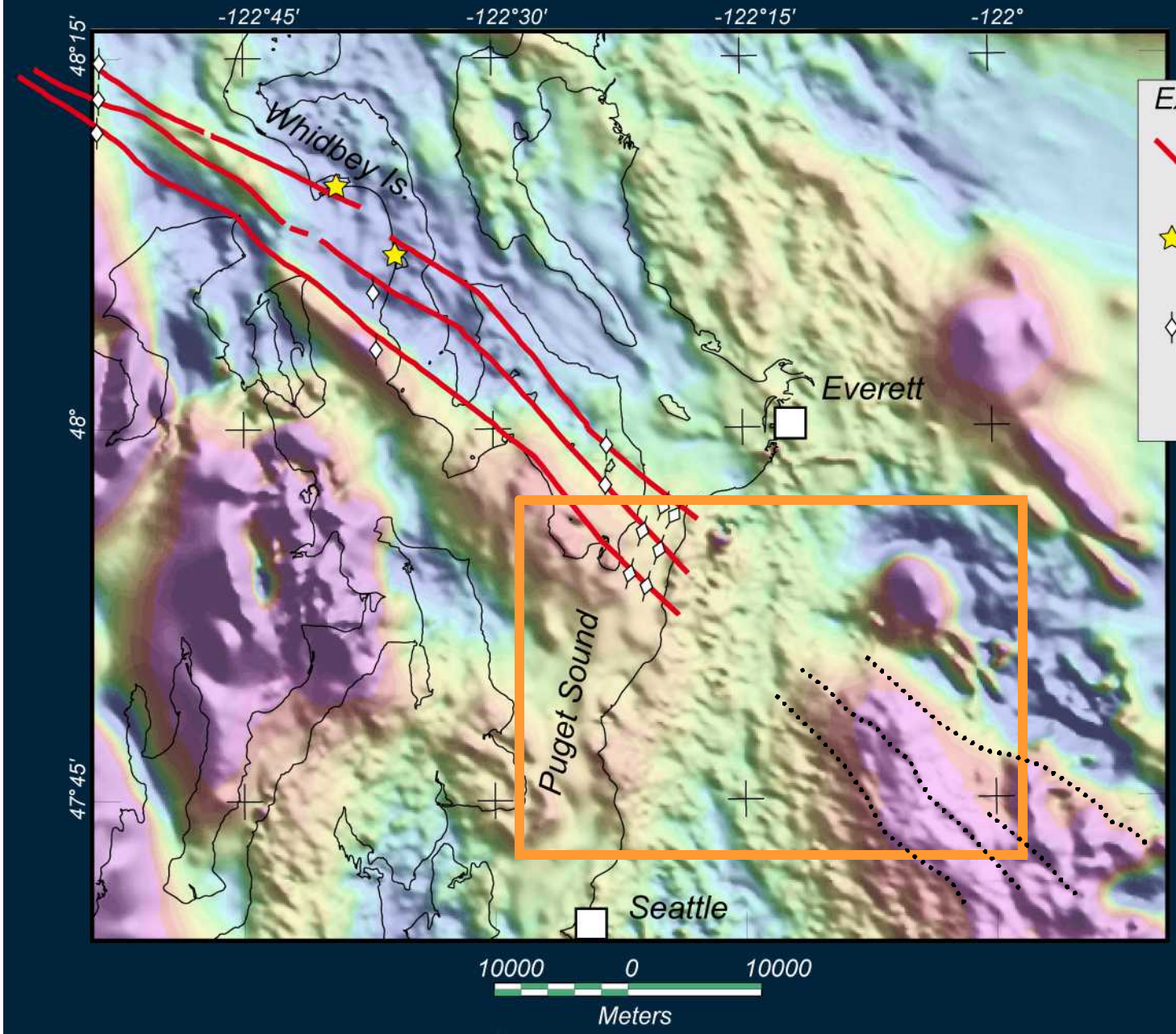


Geology generalized from Dragovich et al. (2002)

The southern Whidbey Island fault straddles several world-class basins.



Aeromagnetic Anomalies and the Southern Whidbey Island Fault

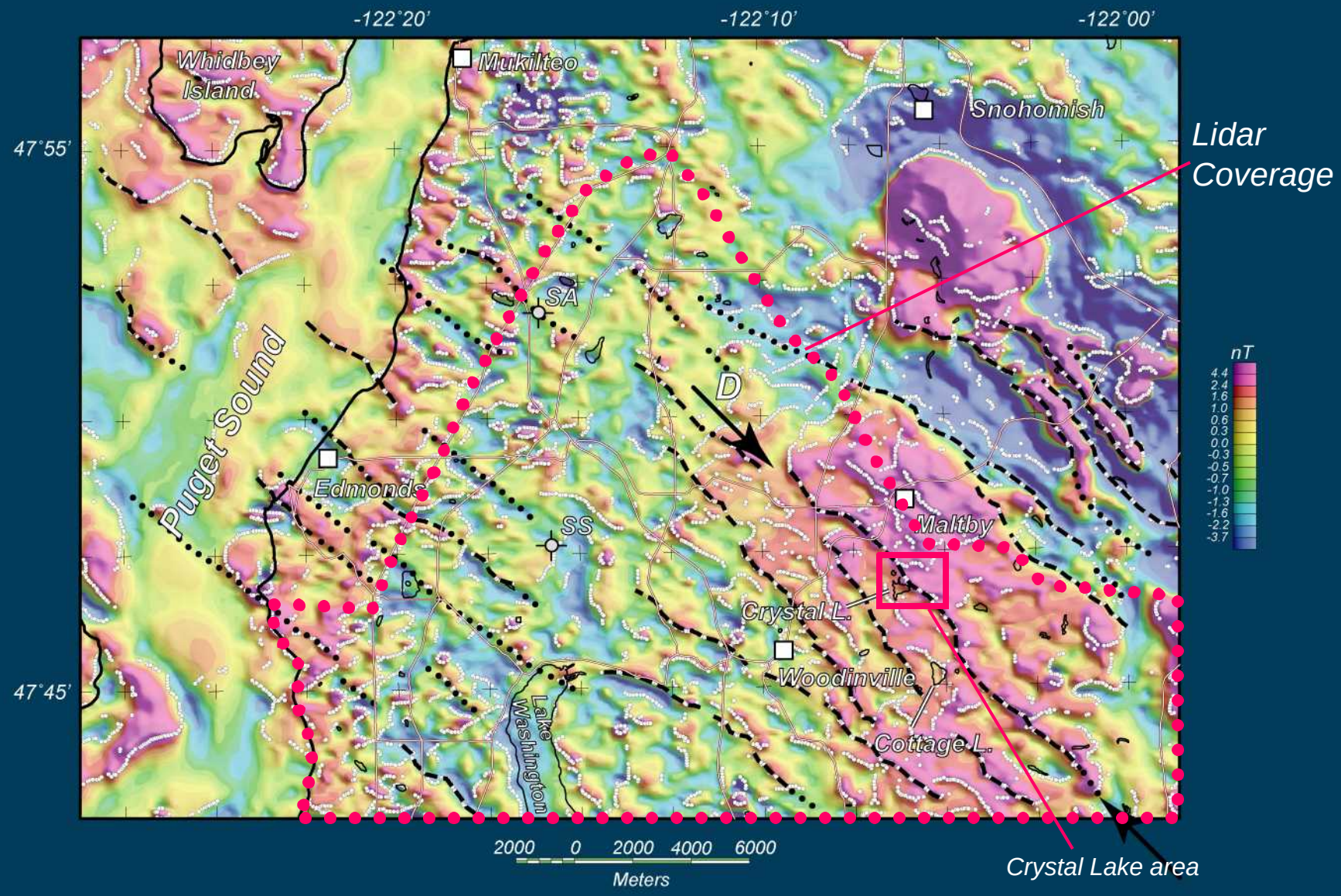


EXPLANATION

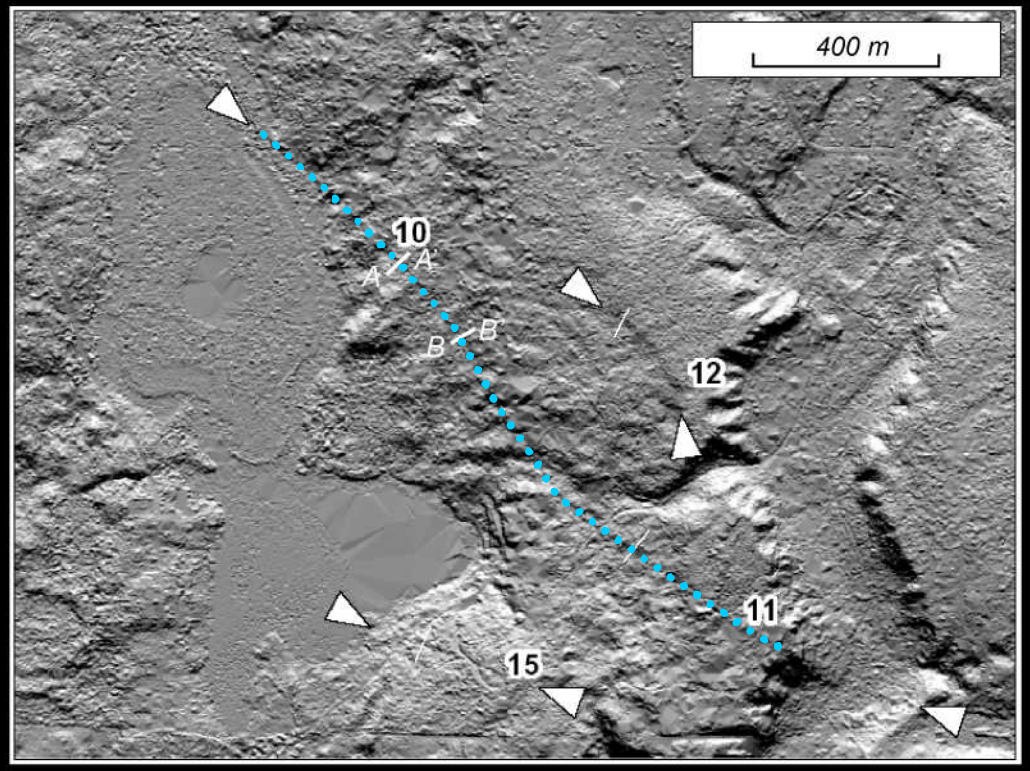
- "Official" southern Whidbey Island fault
- Holocene deformation (Kelsey et al., 2004)
- Faulted Quaternary strata (Johnson et al.,1996)

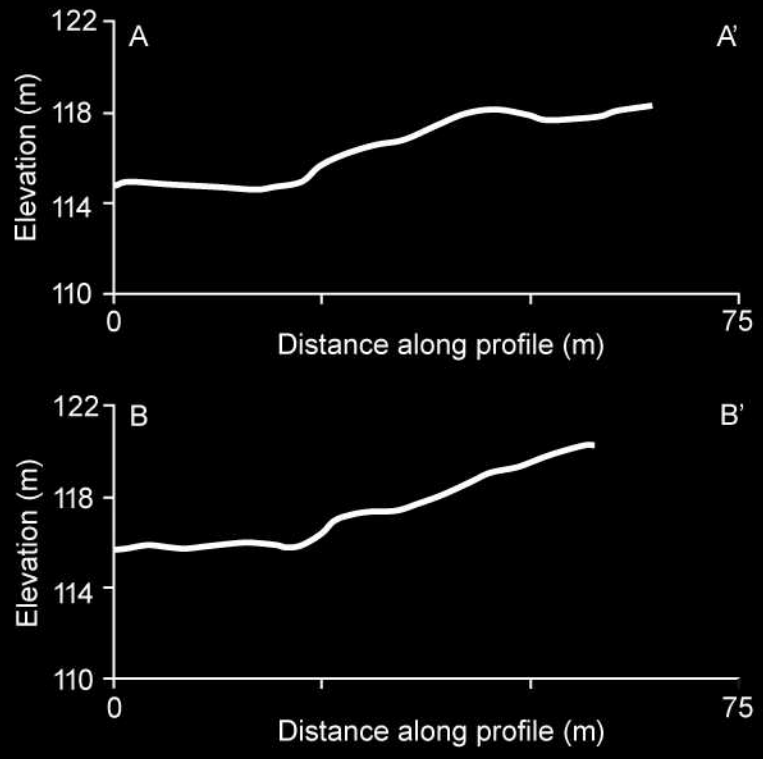
Onshore, several subtle aeromagnetic lineaments are on strike with the southern Whidbey Island fault

Magnetic Interpretations

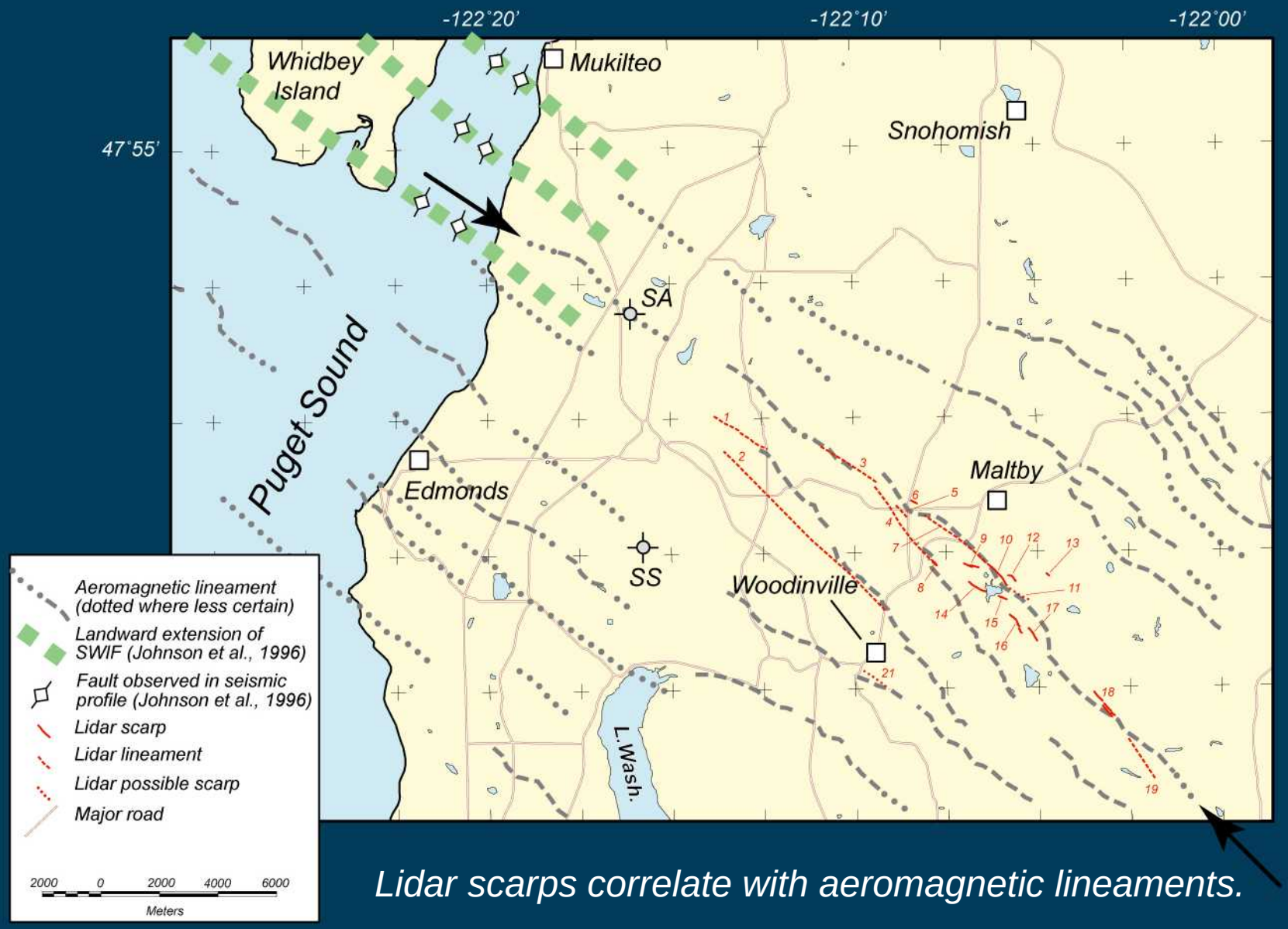


Lidar Image, Crystal Lake Area

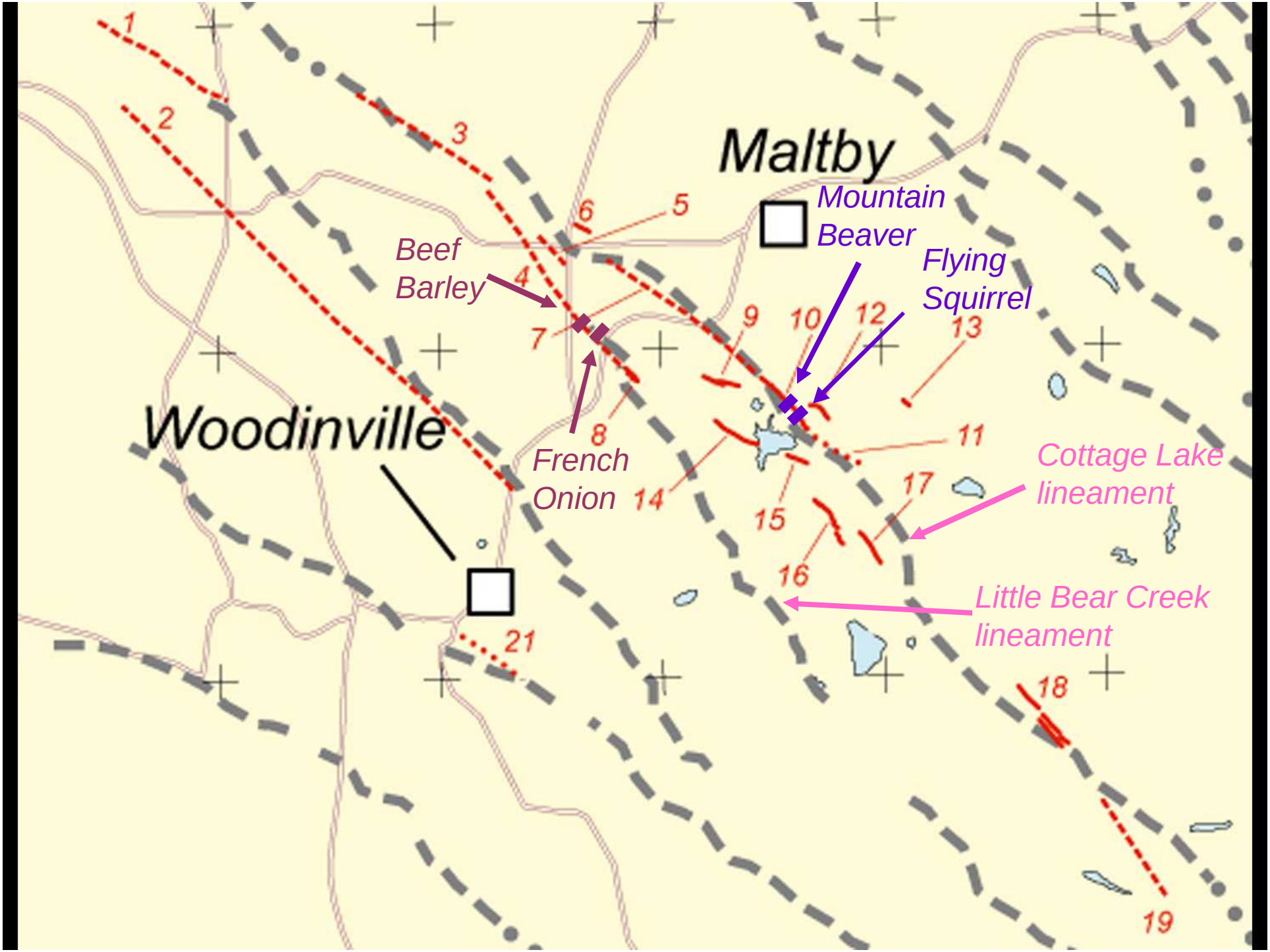




Magnetic Lineaments and Lidar Scarps



Lidar scarps correlate with aeromagnetic lineaments.


Maltby
Woodinville
Mountain
Beaver
Flying
Squirrel
Beef
Barley
French
Onion
Cottage Lake
lineament
Little Bear Creek
lineament
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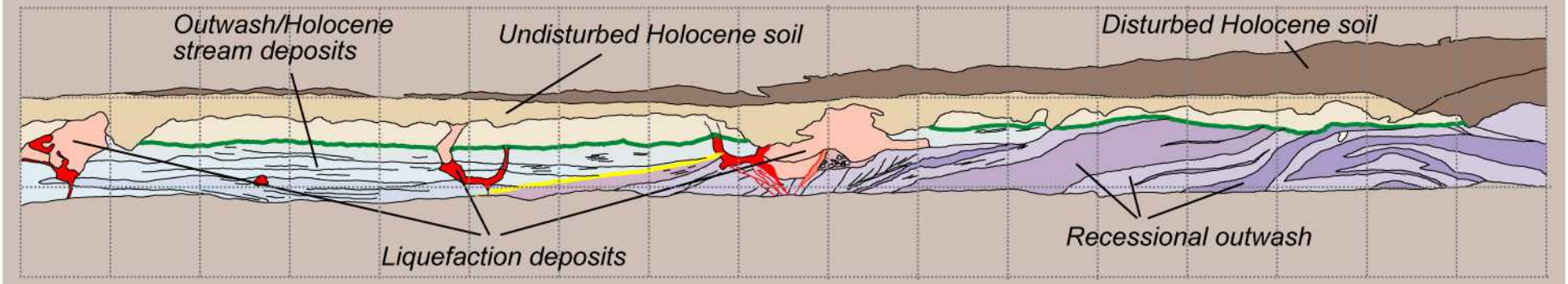
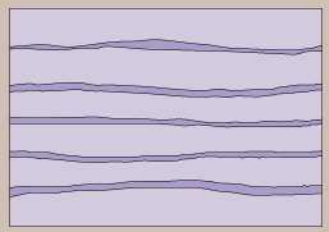
Beef Barley

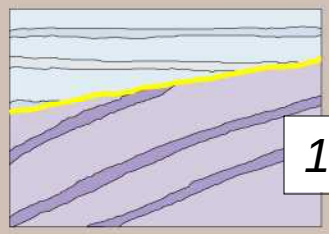
View to SW

Beef Barley Trench Log



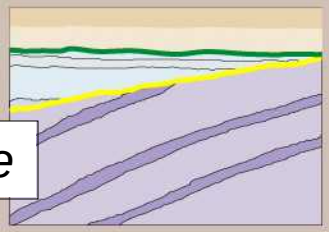


Pre-event 1: Recessional outwash (~16 ka to ~13 k)



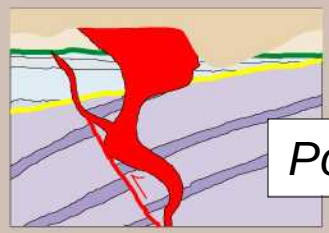
16.4 – 12.0 Ka

Event 1: Folding of outwash and deposition of younger outwash/Holocene fluvial deposits (angular unconformity = yellow line)



Holocene

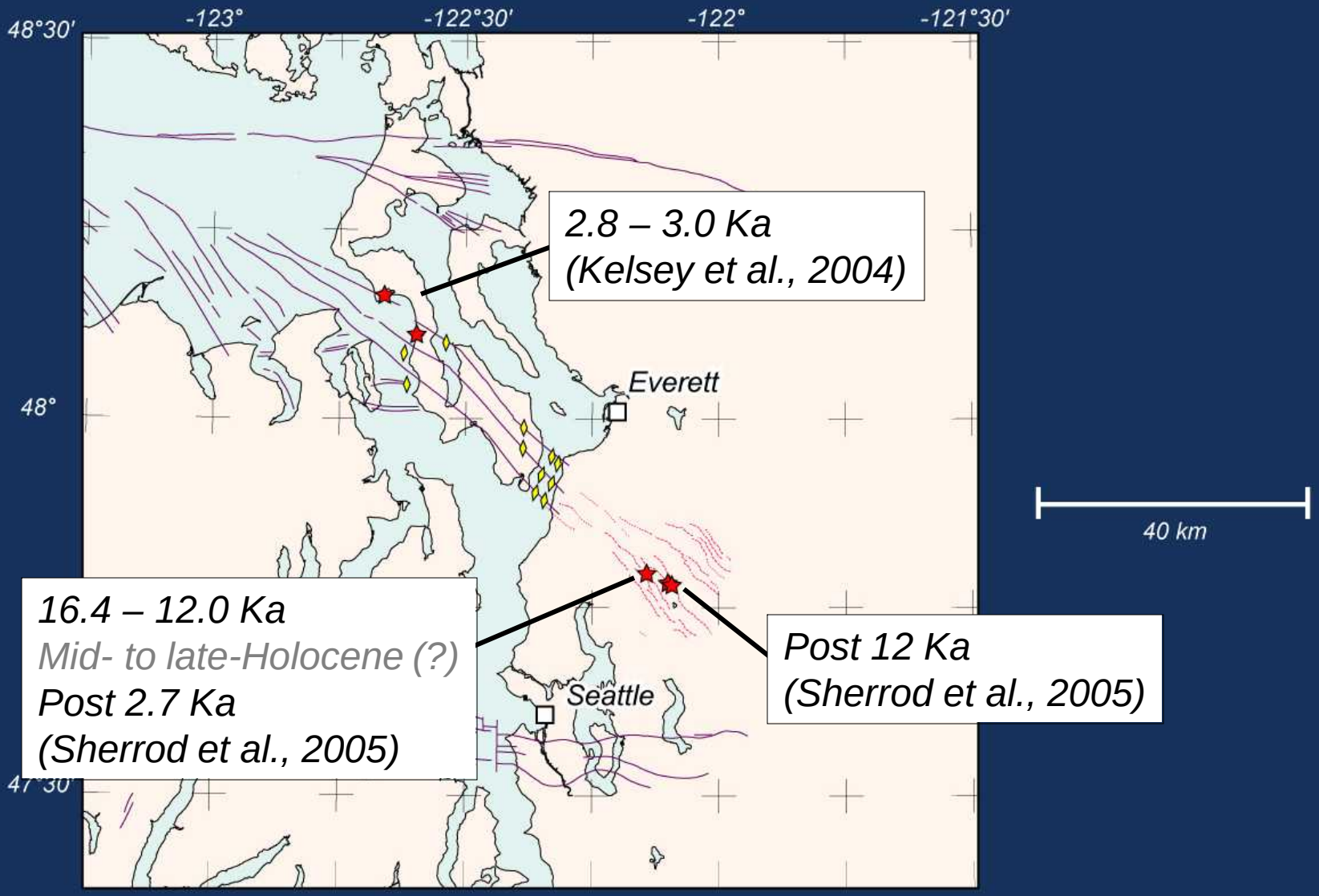
Possible Event 2: Erosion of younger outwash/Holocene fluvial deposits (younger unconformity = green line)



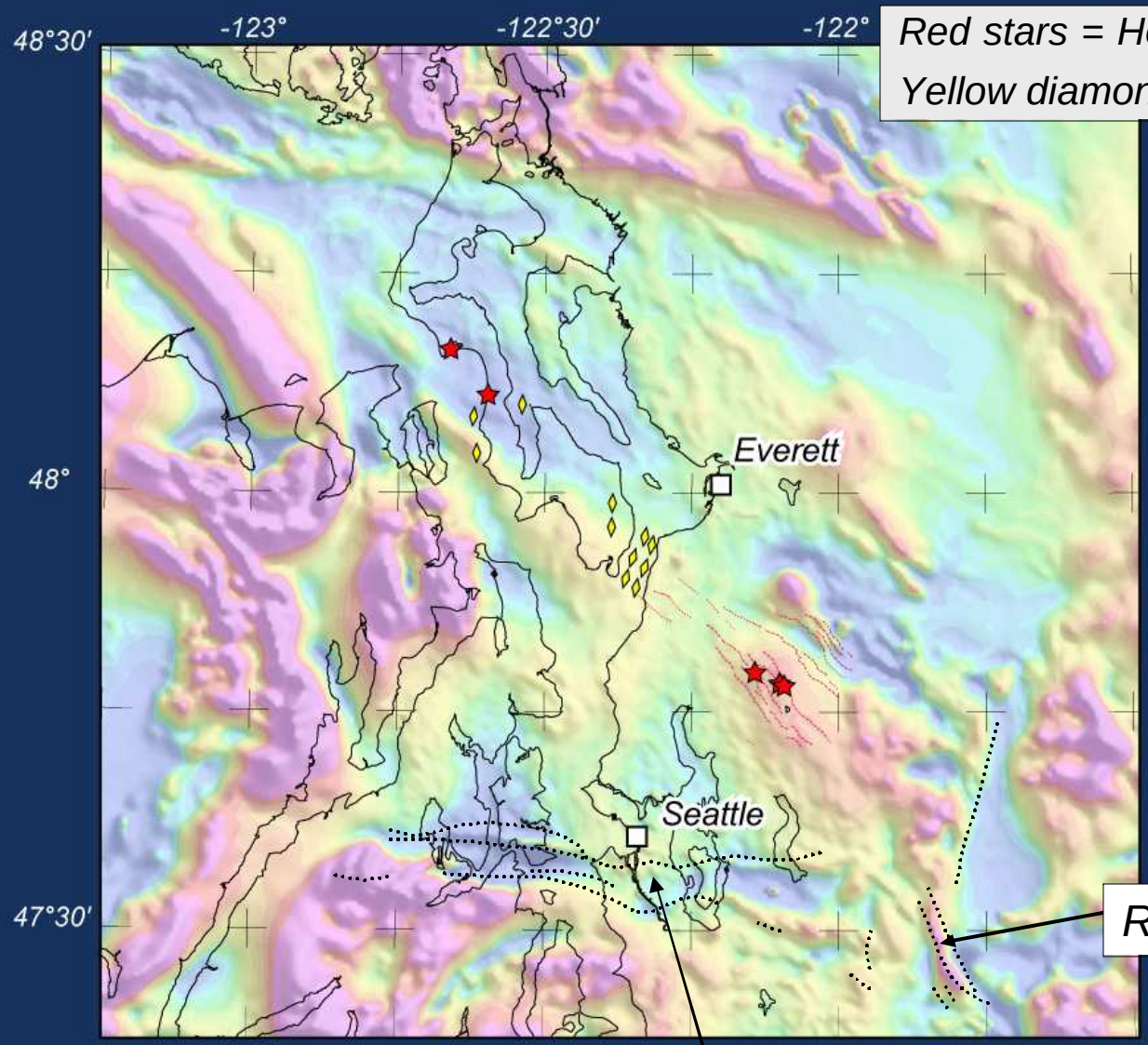
Post 2.7 Ka

Event 3: Faulting and liquefaction, likely accompanied by a small amount of folding (<50 cm)

Holocene Deformation, Southern Whidbey Island Fault



Aeromagnetic Anomalies of Central Puget Lowland



Red stars = Holocene deformation

Yellow diamonds = faulted Quat. Strata

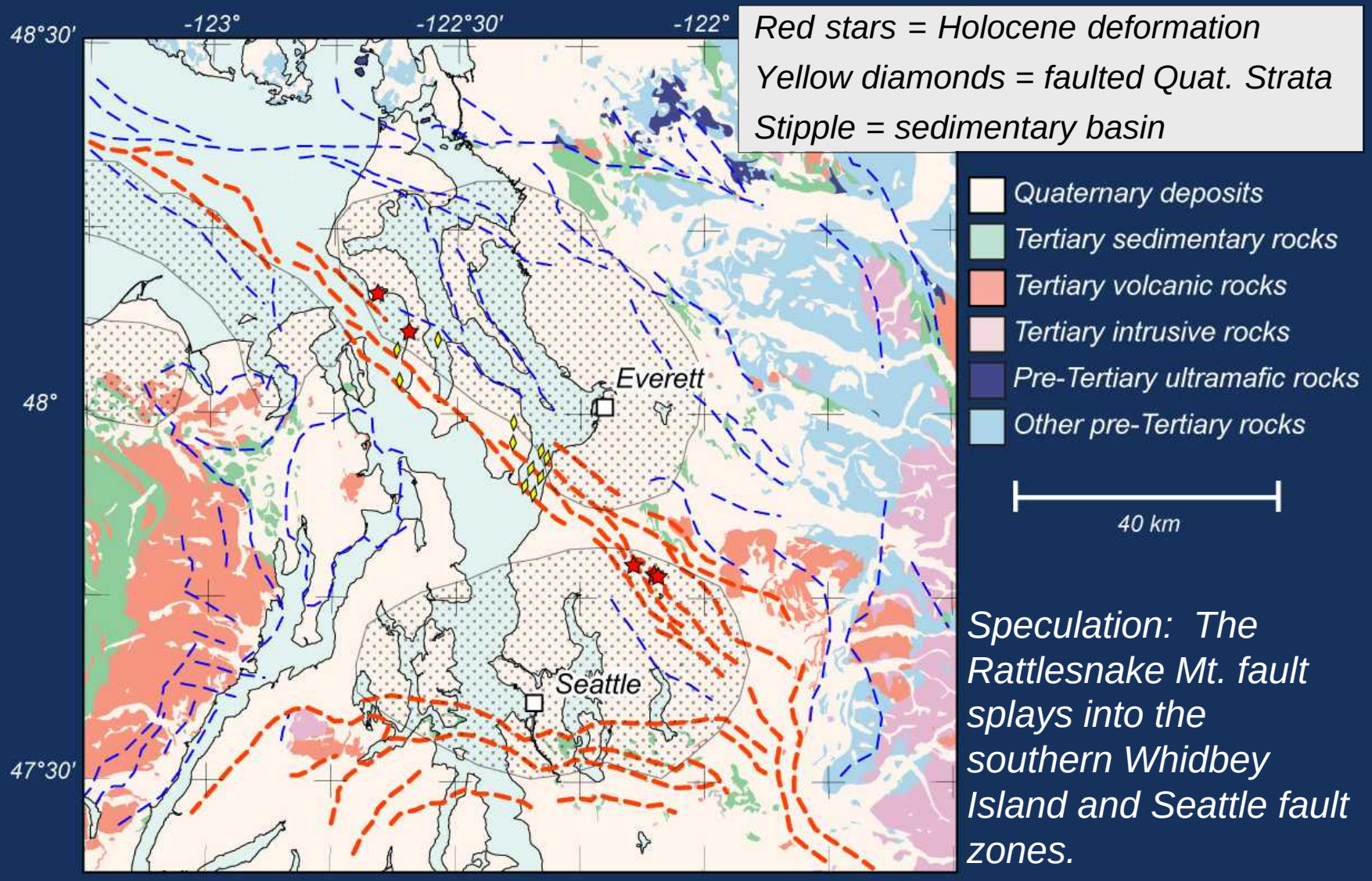
How does the southern Whidbey Island fault interact with the Seattle fault zone and other faults east of Seattle?

40 km

Rattlesnake Mt. fault

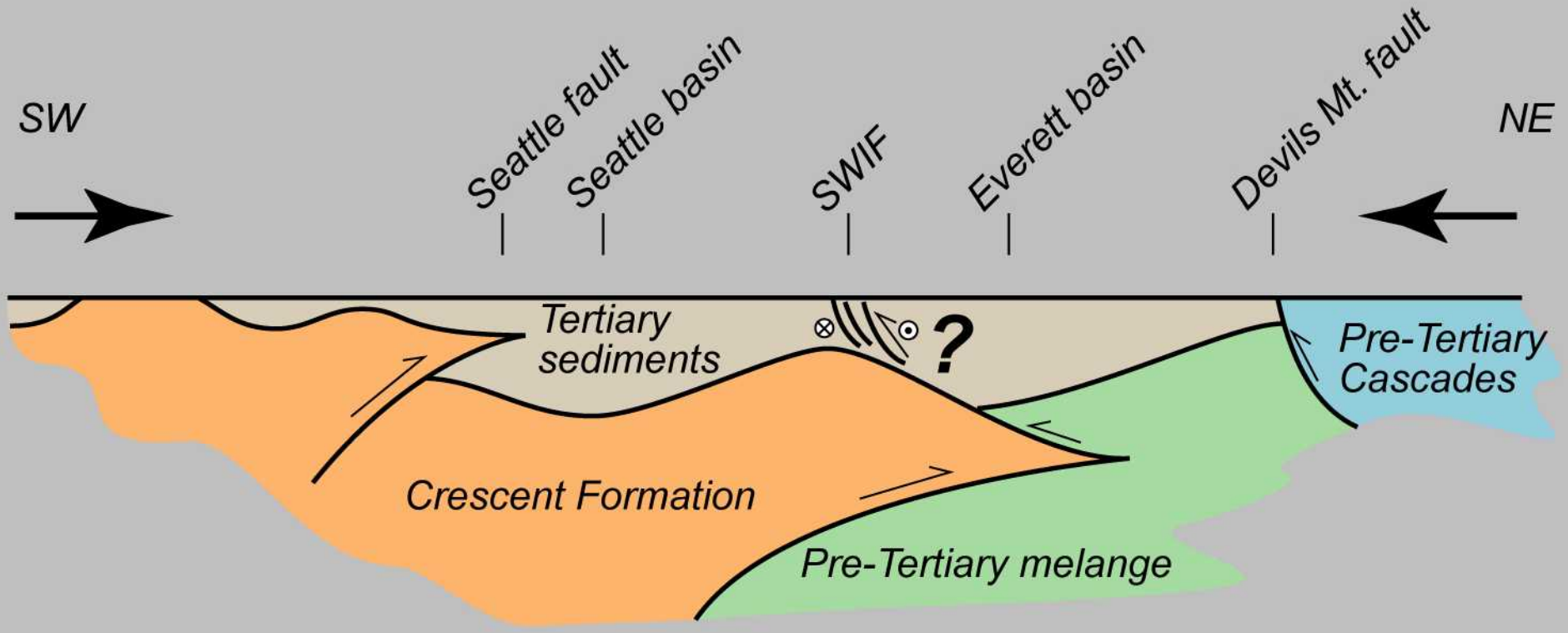
Seattle fault

Connecting the Dots



Speculation: The Rattlesnake Mt. fault splays into the southern Whidbey Island and Seattle fault zones.

Geology generalized from Dragovich et al. (2002)



A northeastward-advancing wedge of Eocene crust, similar to the model proposed for the Seattle fault zone (Brocher et al., 2004), may explain why the southern Whidbey Island fault zone is so broad.