Apr 5th, 2:15 PM - 2:30 PM

Source, transport, and age of sediment from Cascade volcano watersheds to the nearshore: insights for contaminant and ecological studies

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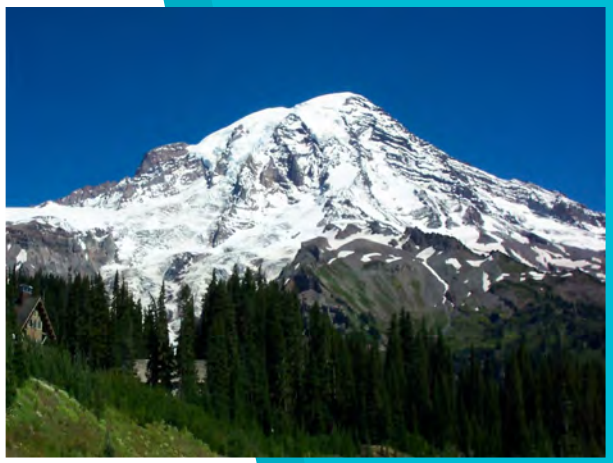

Source, transport, and age of sediment from Cascade volcano watersheds to the nearshore: insights for monitoring studies

Renee Takesue, Kathy Conn, and Margaret Dutch

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DEPARTMENT OF ECOLOGY State of Washington

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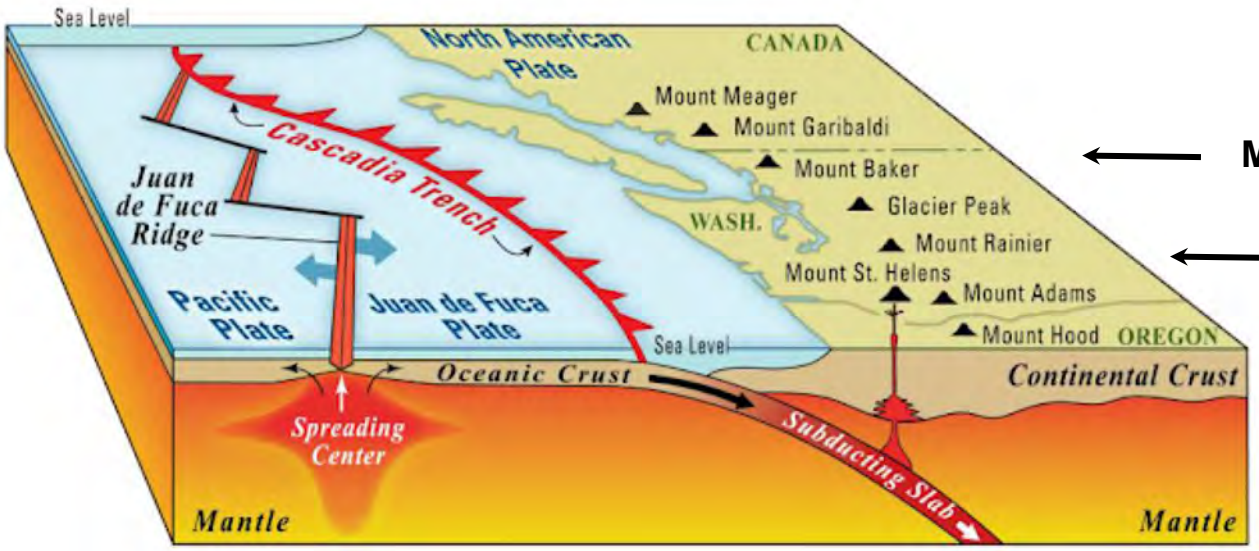
North Cascade Volcanoes



Mt. Baker

Mt. Rainier

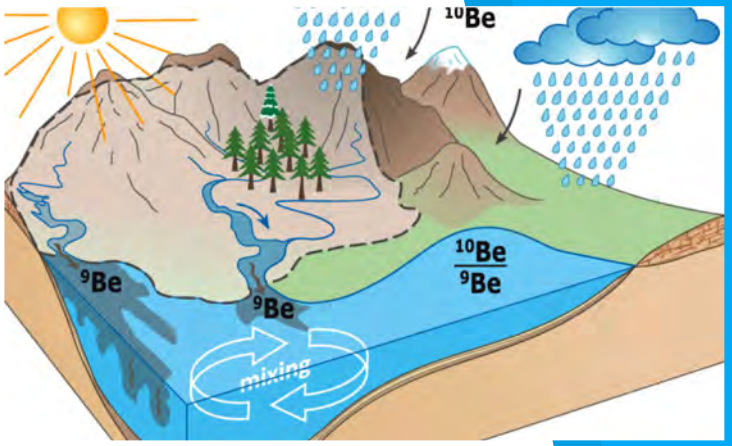
- YOUNG, ACTIVE volcanoes
- Near large population centers
- Volcanism + snow ⟶ lahar (ash flow)

Andesitic lavas

Geochemical sourcing, aging

- **Geology of watersheds**
  - Rocks + weathering = Soil + transport = SEDIMENT
  - Rock types have distinct chemical compositions

- **Age of sediment**
  - Rates of radiometric decay of atmospheric particles delivered to the earth's SURFACE
  - High affinity for sediment, OM
  - Erosion, transport to depositional envir.
  - ^{7}Be (up to 5 mo.)
  - ^{210}Pb (3 yr - 100 yr)



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Mt. Rainier→ Puyallup River→ Commencement Bay

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Comm. Bay

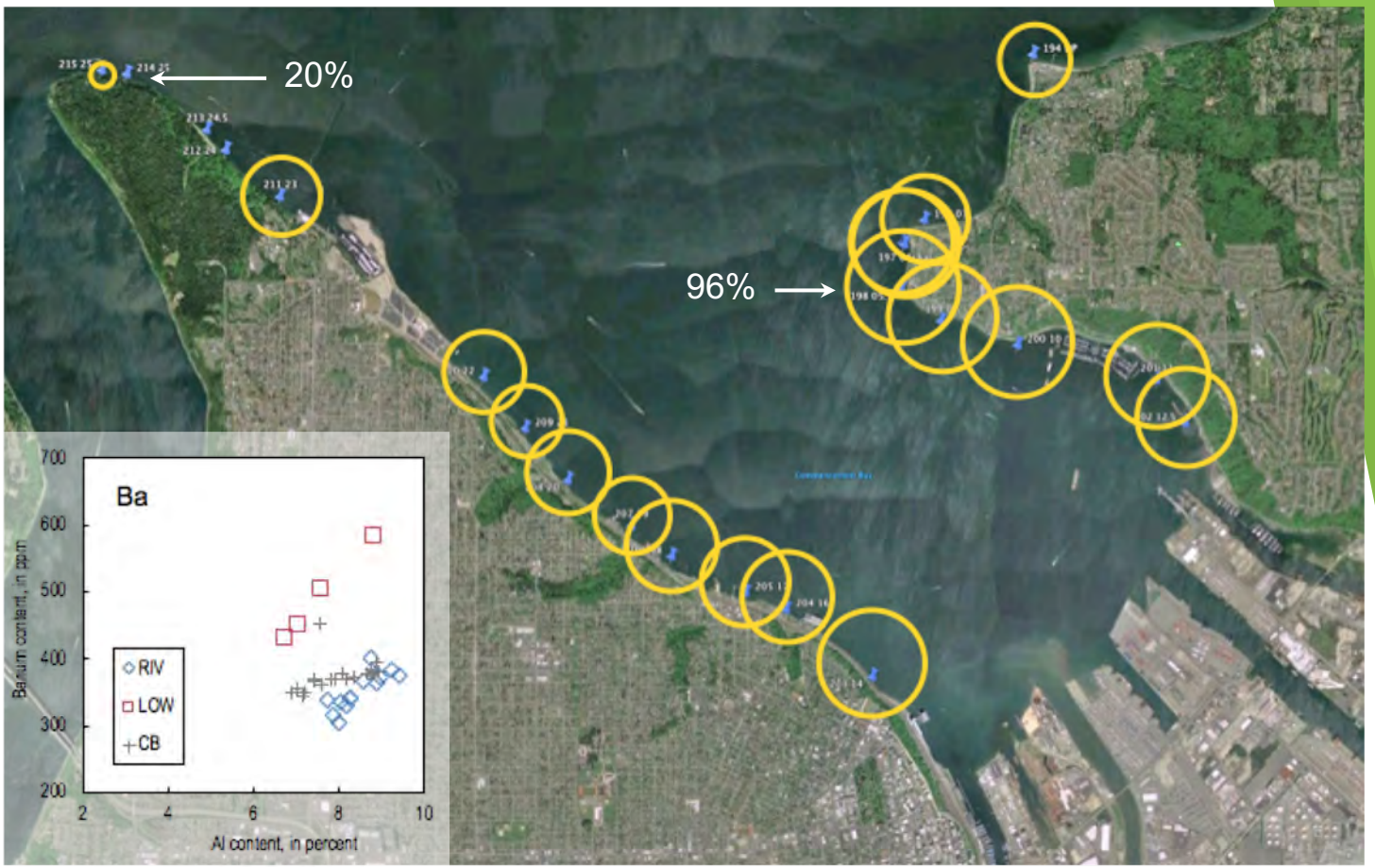
Czuba et al. (2010)

65 km (40 mi.) from Tacoma
2,460 sq. km (948 sq. mi.)

Puyallup River / Commencement Bay

- What is the fate of fluvial sediment (and contaminants) in CB?
  - Sediment sourcing RIVER vs. BLUFF
  - PAHs, wastewater ind., hormones, PCBs, PBDEs
- Can recent sedimentation (and contaminants) be distinguished from pre-existing?
  - Sediment aging (^{7}Be)
- What are the implications for biota?
  - Forage fish spawning beaches

Sourcing: % River v. Lowland

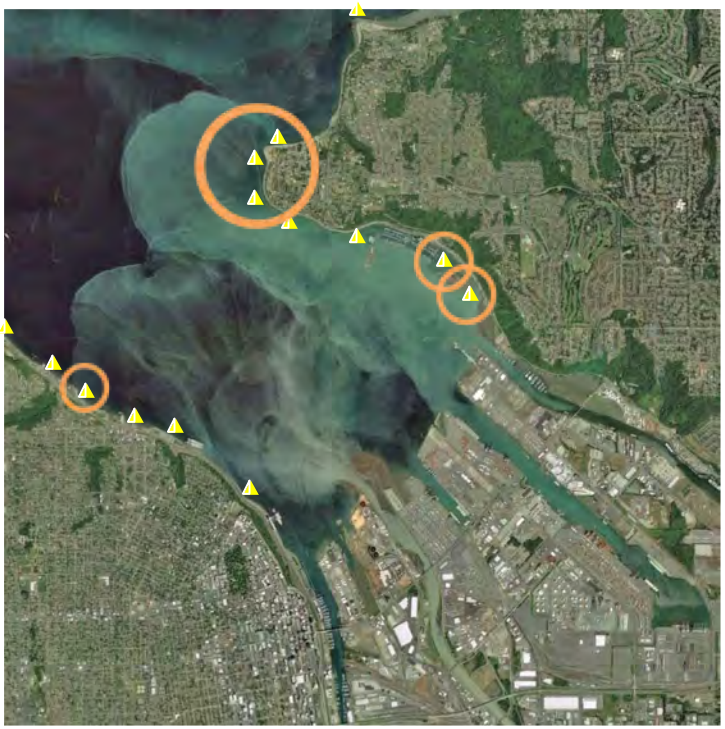


Upper 0-2 cm seabed sediment

Aging: Recent deposition (winter, historical)

^{7}Be (last 5 months)

^{210}Pb (last 100 yr)



Upper 0-8 cm seabed sediment

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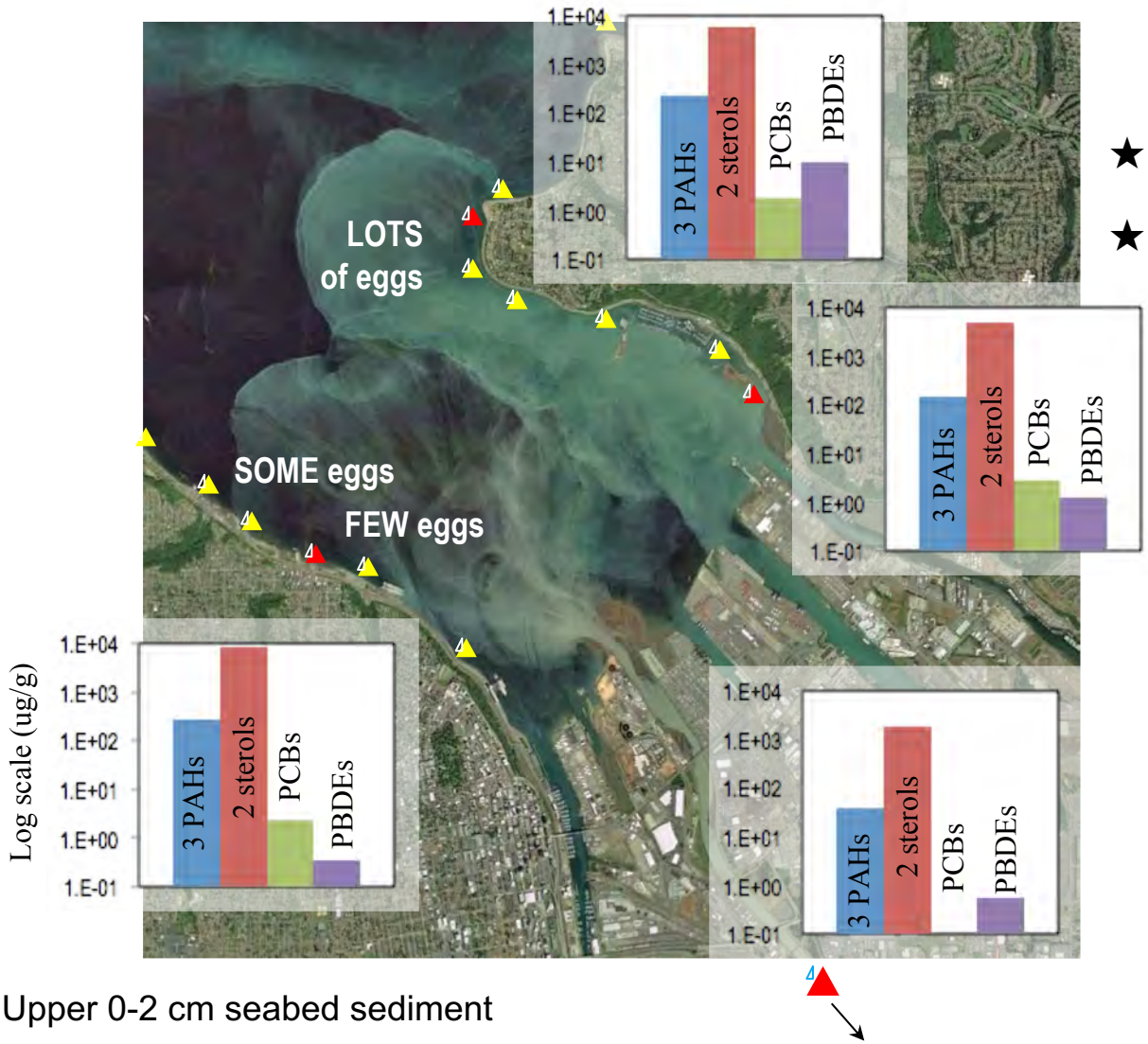
Contaminant patterns in CB

- ★ Higher in BAY than river;
- ★ Higher in WINTER than summer;
- ★ PAHs, waste ind., PCBs, (metals) highest at SOUTH shore/Tacoma waterfront;
- ★ Only 1 higher on the north shore;
- ★ Forage fish spawning beaches



Upper 0-2 cm seabed sediment

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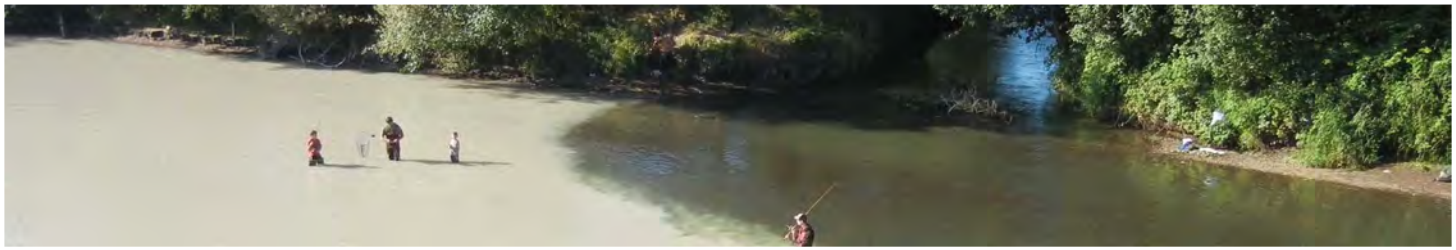
Summary (Puyallup/Comm Bay)

- River source >> Bluff source in CB
  - North shore > south shore
- Sediment aging was essential:
  - North shore > south shore
- Contaminants
  - South shore (Tacoma) > north shore
    - Pre-existing contaminant sources predominate
  - Winter > summer (Climate change?)
- Forage fish spawning site / river / fewer cont.



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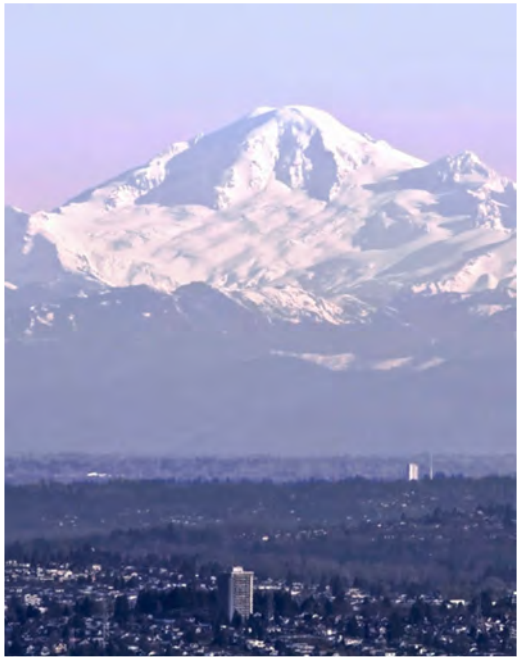
Mt. Baker → Nooksack River → Bellingham Bay



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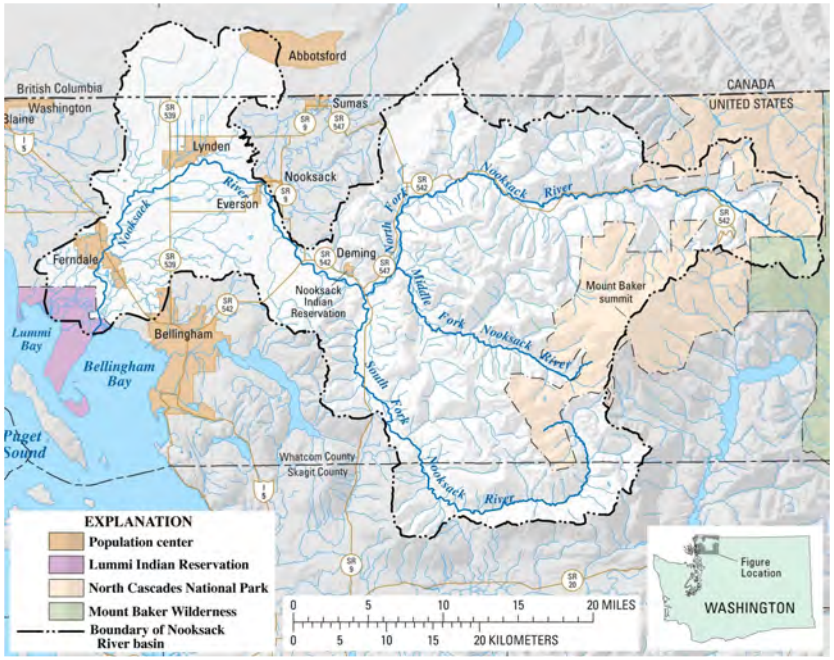

Curran and Olsen (2009)

154 km (96 mi.) from Bellingham
230 km (143 mi.) from Vancouver
2,036 sq. km, 786 sq. mi.

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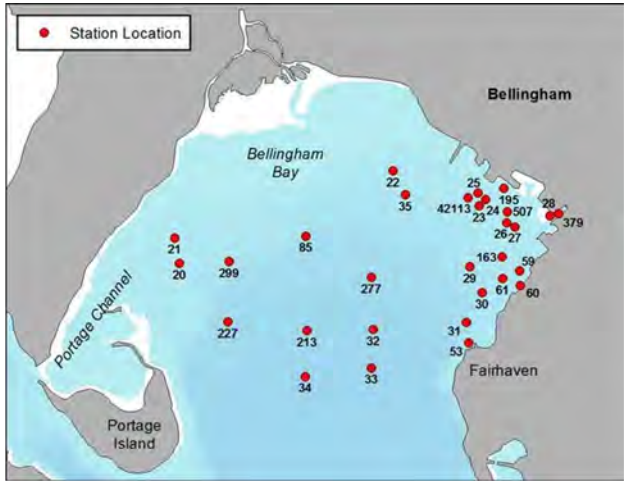
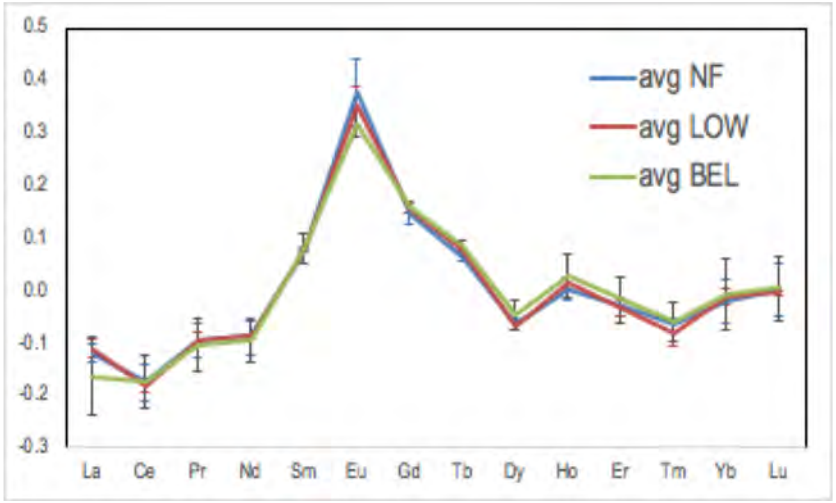
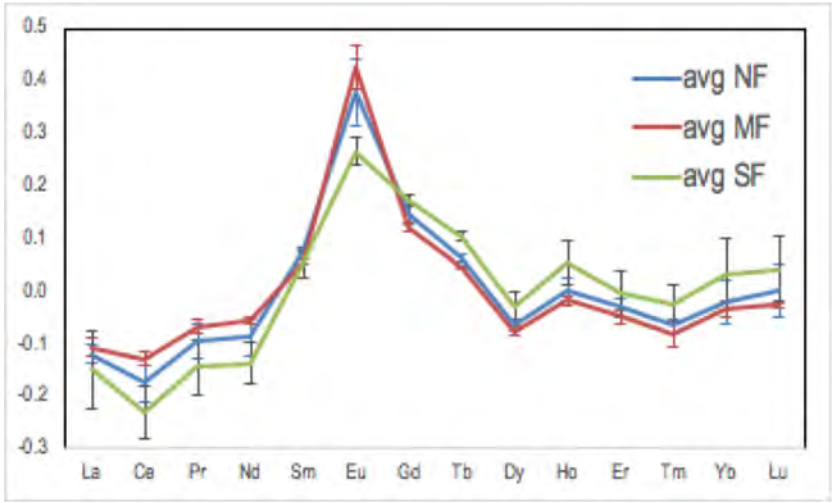
Questions:

- Can NF, MF, SF sediment be distinguished?
- How is terrestrial (river) sediment and OM distributed in Bellingham Bay?
  - Sediment sourcing RIVER vs. LOWLAND
- Are terrestrial input and contaminants related?
  - Collaboration with WA ECY Urban Bays proj.



Geochemical signatures (Rare Earth Elements)





★ River = Lowland (glacial deposits)

★ Lowland = Bellingham Bay

∴ River = Bellingham Bay

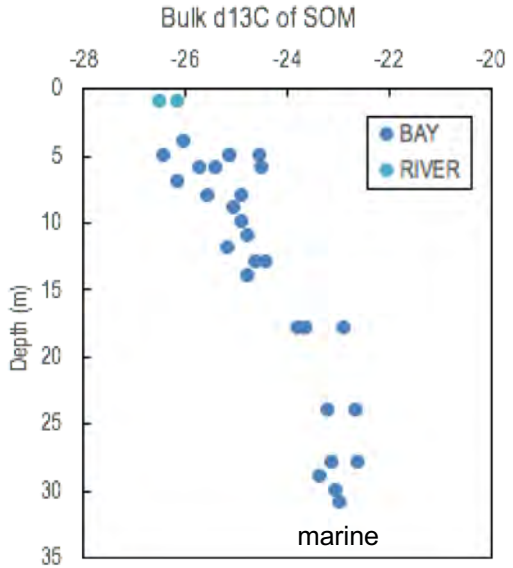
★ North Fork sig. = Middle Fork sig.

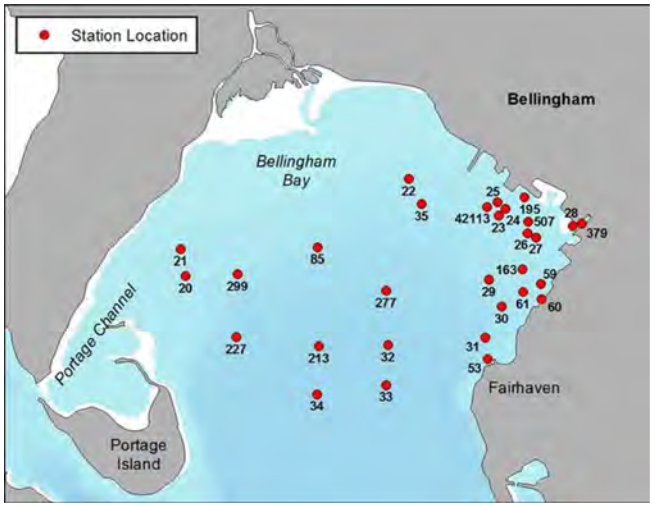
≠ South Fork sig.

★ Summer runoff

Bulk $d^{13}C_{SOM}$

- Terrestrial $d^{13}C$ values closer to shore





- River influence decreases with distance offshore

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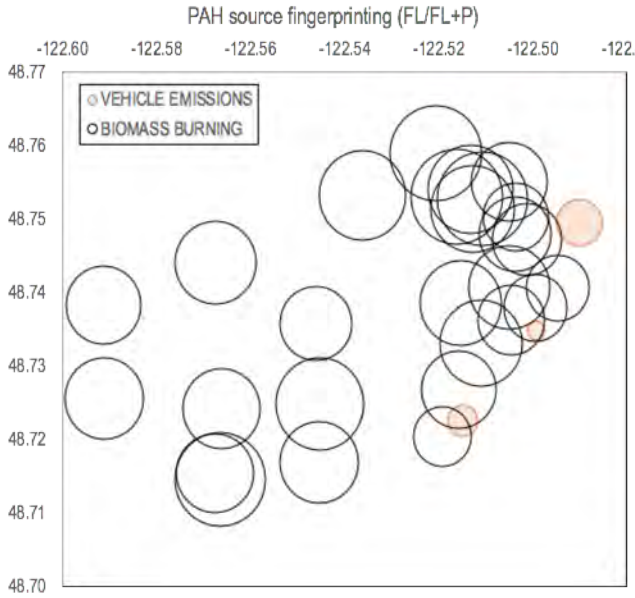
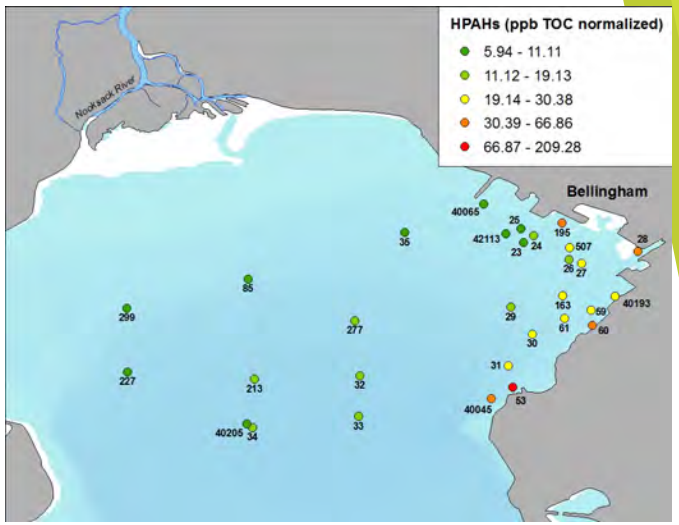
Contaminant patterns in Bellingham Bay

- Biomass/Emission PAHs (left), summed PAHs (right), anthr. metals





- No association between river influence and PAHs, metals

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Summary (Nooksack/Bellingham):

- River = Lowland = Bellingham Bay
  in summer could not be distinguished geochemically
- River discharge not a big source of PAHs, metals
  - Agricultural compounds?
- South Fork sediment was distinct from North, Middle

Implications

In the face of changing climate and human pressures, sediment sourcing and aging can:

- ★ Show the role of large rivers, urban centers as sources of sediment, OM, and contaminants;
- ★ Distinguish new inputs from pre-existing;
- ★ Show transport pathways

→ Improve understanding from long-term monitoring about changing processes that structure ecosystems.

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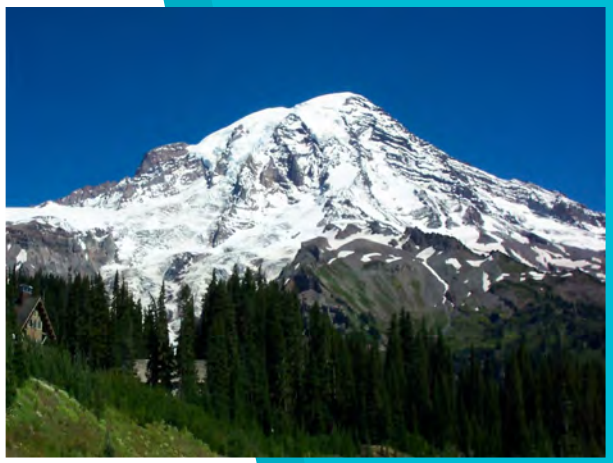
Acknowledgments



Funding:

USGS Coastal & Marine Geology Program

USGS Ecosystems Mission Area

Assistance:

James Foreman, USGS, Commencement Bay sampling

Rich Sheibley, USGS, Puyallup River sampling

Colin Smith, USGS, forage fish egg survey

Cordell Johnson, USGS, radionuclide analyses

Valerie Partridge, WA Dep. Ecology, Bellingham Bay sampling

Sandra Weakland, WA Dep. Ecology, Bellingham Bay PAH data

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