Reading Material

“River Deltas”
from “The Coast of Puget Sound”
J.P. Downing, Puget Sound Books
Field Trip B

Working cruise in Puget Sound on the Thompson, UW's oceanographic research vessel

Wednesday
October 24

All day
(no class)
Puget Sound Cruise

Time: Depart UW 7AM Oceanography Parking Lot
Return UW 9 PM Oceanography Parking Lot

Clothing: foul-weather gear, hat, fleece, good shoes
Prepare for cold, wet, windy and muddy conditions

Food: Lunch and dinner onboard ship
Special dietary needs?
Observations during cruise

Water column

CTD = chlorinity, temperature, depth
turbidity (suspended sediment)

Seabed

Grab samples – surface sediment
box core – 50-cm-long piece of seafloor
kasten core – 250-cm-long record of sedimentation

Seafloor mapping
multibeam acoustic profiles

Below seafloor
seismic profiles
Puget Sound Morphology

Glacial Origin

scour – flow under ice sheet
formed depressions
e.g., Main Basin, Hood Canal, Lake Washington

sedimentary deposits – also raised land surface
glacial tills, outwash deposits, lake deposits

old glacial sediment now provides new input to PS
cliff erosion
landslides
land surface erosion
Bathymetry (water depth)

Shallow entrance
  glacial origin – moraine
  oceanographic name – sill
  primary sill is Admiralty Inlet

Several others divide PS into separate basins (>200 m)
  Main Basin has 46% of water volume

Sinuous shape – result of origin
  Southern Basin has 29% of shorelines

Fluvial (river) sediment supply
  fills PS from shoreline
  Whidbey Basin has 43% of tidelands
Depth at Sites
Admiralty Inlet 66 m
Deception Pass 13 m
Swanomish Slough 3 m
Gedney Island 97 m
The Narrows 44 m
Nisqually Slough 31 m
South Point 53 m
Oak Head 125 m
Hydrography (water properties)

Salinity (amount of salt dissolved in water)
river water has 0 ppt (parts per thousand)
ocean water has ~35 ppt - differs around world
brackish water at depth in PS - 20-30 ppt

Density (low salinity = low density)
river plume flows over more dense brackish water

Input of river water - varies with space and time
northern PS rivers supply the most water
small input during late summer
large input during late autumn and winter rains
large input during spring snowmelt
Types of river-mouth environments

estuary - semi-enclosed setting
    river and salt water meet and mix

fjord - estuary with glacial origin
    deep, with shallow sill near mouth

delta - river mouth receiving much sediment
    estuary filled with sediment
    shoreline growing seaward
Puget Sound Sedimentation

Sources of sediment
- shallow - shoreline erosion, landslides
- deep - biological productivity, algal debris
  much carbon decomposes,
  forming methane gas
- all depths - river discharge
  deltas form near river mouths
  river plume carries sediment deeper
- near sill - inflow with deep ocean water
Mechanisms associated with Sedimentation

plume transport - turbid surface water river momentum, tides, wind

flocculation - silt and clay particles form larger aggregates, which sink quickly

landward bottom flow - traps sediment near river

delta formation - thick deposits near river mouth
topset = tidelands
foreset = steep surface, rapid accumulation
bottomset = deep deposits, escape seaward
Duwamish delta

Intensely impacted by humans

Wetlands hardened (landfill, roads, parking lots, buildings)

Distributary channels altered and stabilized
depth in m

Duwamish delta
4-m resolution, 5x VE
Nisqually delta
nearly natural condition

Several distributary channels bring water and sediment across delta to Puget Sound
Nisqually Delta, 5x VE
3-m resolution, looking SW