SF Bay Cores
Uncovering Our Dirty Past

RMP Annual Meeting 2009

CORE

WHAT IS IT GOOD FOR?

ABSOLUTELY

SOMETHING

Sediments Tell Our History

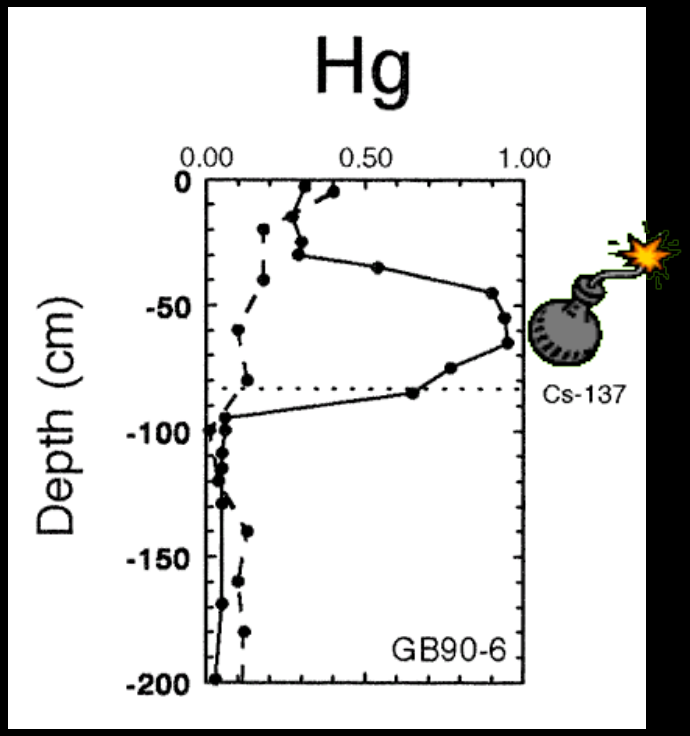
America's largest core?

SF Bay core to scale >

Even when not neatly stacked, a history of process

SF Bay - Cored Before

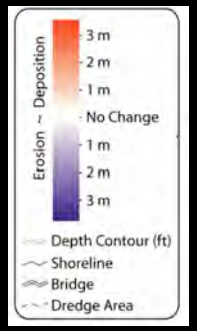
- USGS (1990) cores
  - 90+ sites screened only
  - 2 depositional sites in detail
    - Polluted max subsurface
  - Pollutant reservoir
    - Much of SF Bay eroding
    - Ticking TIME BOMB?!!!

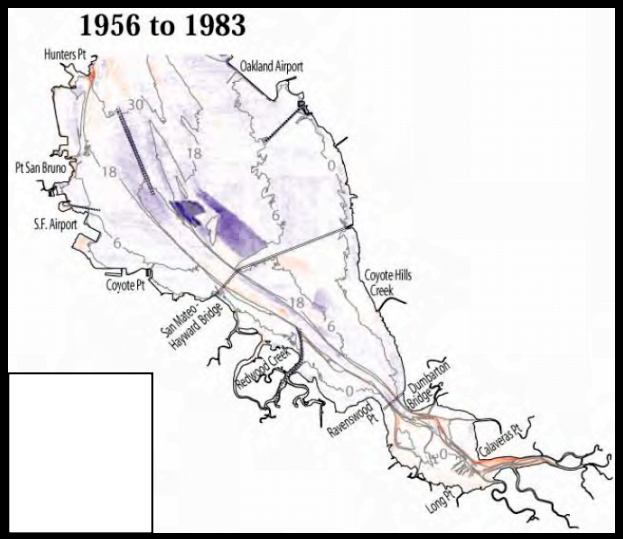


Hornberger 1999

Why Recore?

- Need baywide inventory to predict trajectory
  - 2 of 90+ sites probably not representative
  - Much of Bay erosional, not depositional (Jaffe et al)

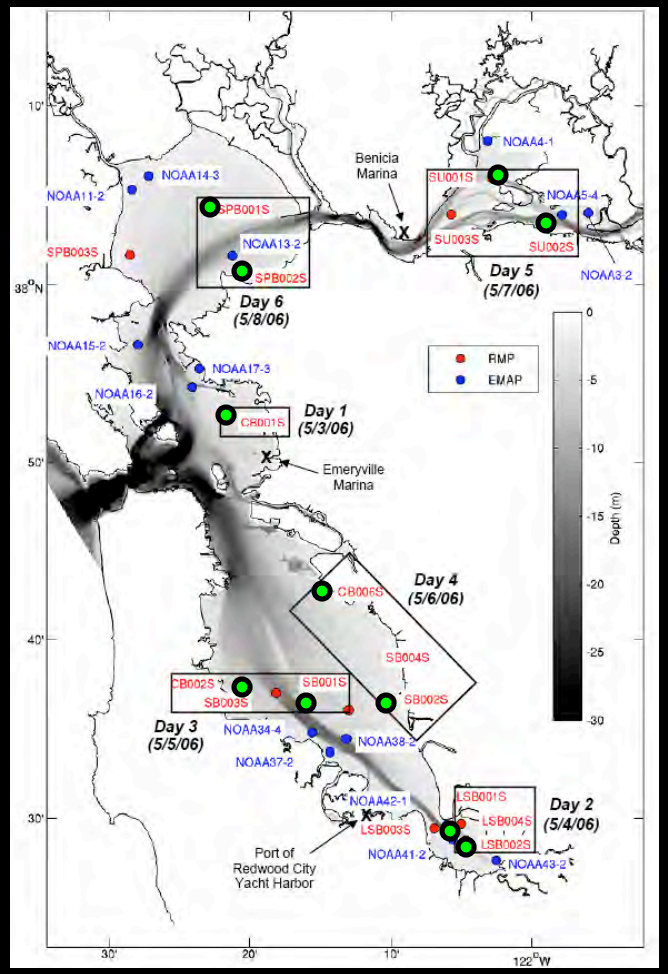




- Use those previous 90+ cores?
  - Old, unusable for chemical analyses

11 Bay (Underwater) Sites

- Random, representative (inventory, processes)
  - 3 sites Central Bay,
  - 2 each other segments
  - Mostly RMP annual repeat stations



Bay Vibracoring

6 Wetland Sites

- Loading history
  - Depositional zones
- 1 site each segment
  - Pt Edith (Martinez)
  - Wildcat (Richmond)
  - Damon Sl. (Oakland)
  - Greco Island (R.C.)
  - Coyote Creek (S.J.)

+ Alviso Marina (for New Almaden)

Wetland Piston Coring

What Did We Expect?

- Pollutant distribution - function of
  - Local land use/pollutant loading
  - Sediment process history
- Sedimentation rates and dates
  - Similar in segment (shared water, sediment)
  - Mid-scale differences (source proximity, etc)

- How do we get rates and dates for cores?

Date A Core

Dating: Bathymetry

2006

1983

1956

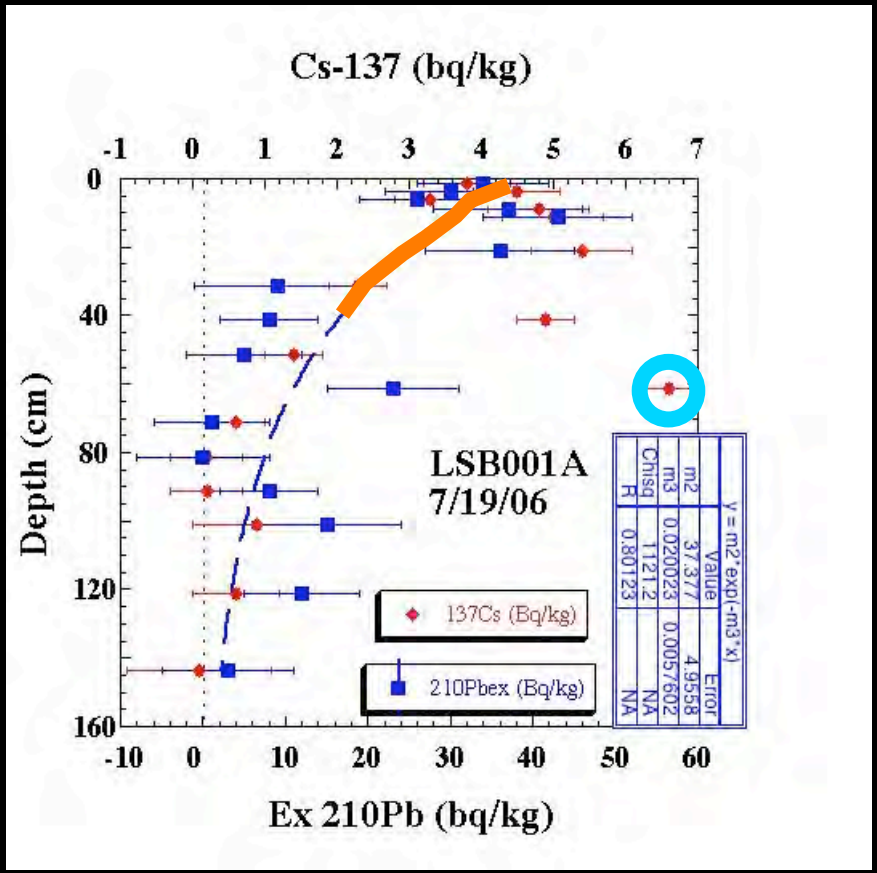
1931

1898

(USGS Bruce Jaffe)

- Net bathymetric change between surveys
  - + deposition – erosion
- Some sites depositional & erosional different periods

Dating: Radioisotopes



(USC Hammond)

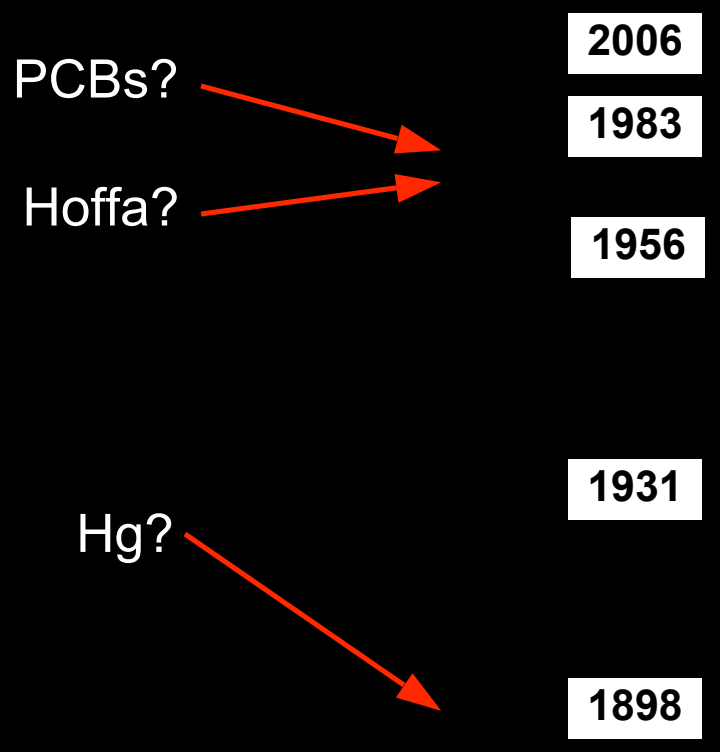
- ^{137}Cs in atom bomb
  - Post ~1950
  - Max ~1960
- ^{210}Pb decay
  - Half life 22 yrs
  - Decay/dilution can look similar
    - If Cs & Pb similar, likely dilution

Dating Results

- Sites within segments similar
  - Suisun, San Pablo erosional
  - Central, South neutral/erosional
  - Lower South depositional
- Radiodating/bathymetry results similar
  - Not perfect matching given spatial variation/resolution of bathymetry

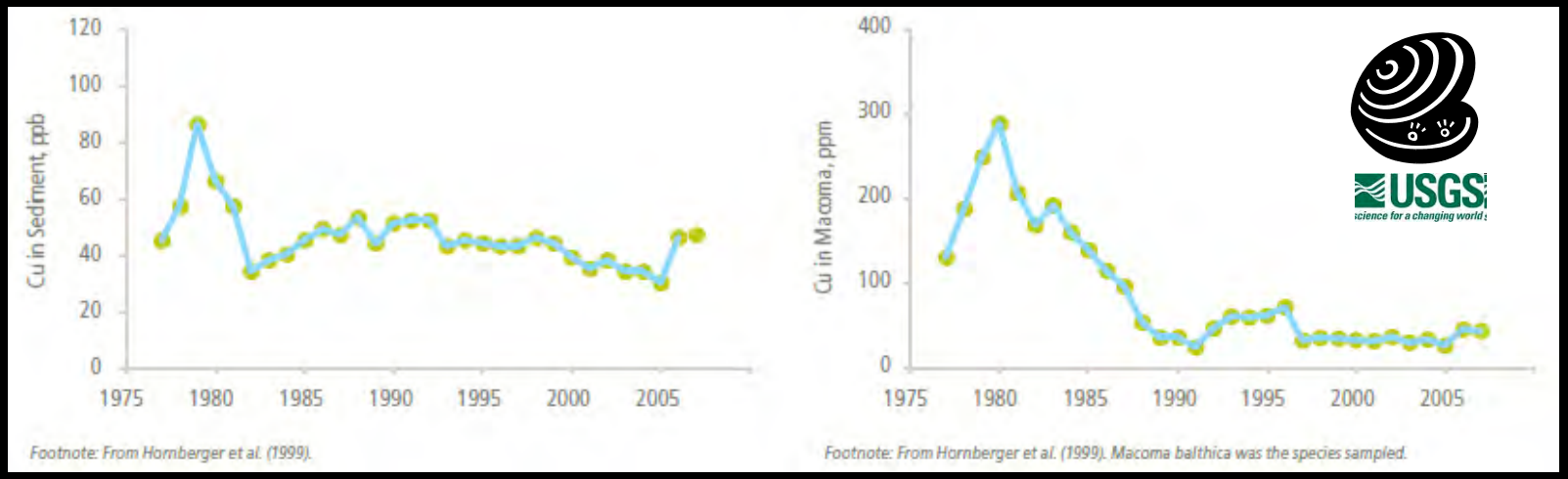
Digging Into Our Dirty Past

- Age of layer → hints what you might find



Our Dirty Past: Copper

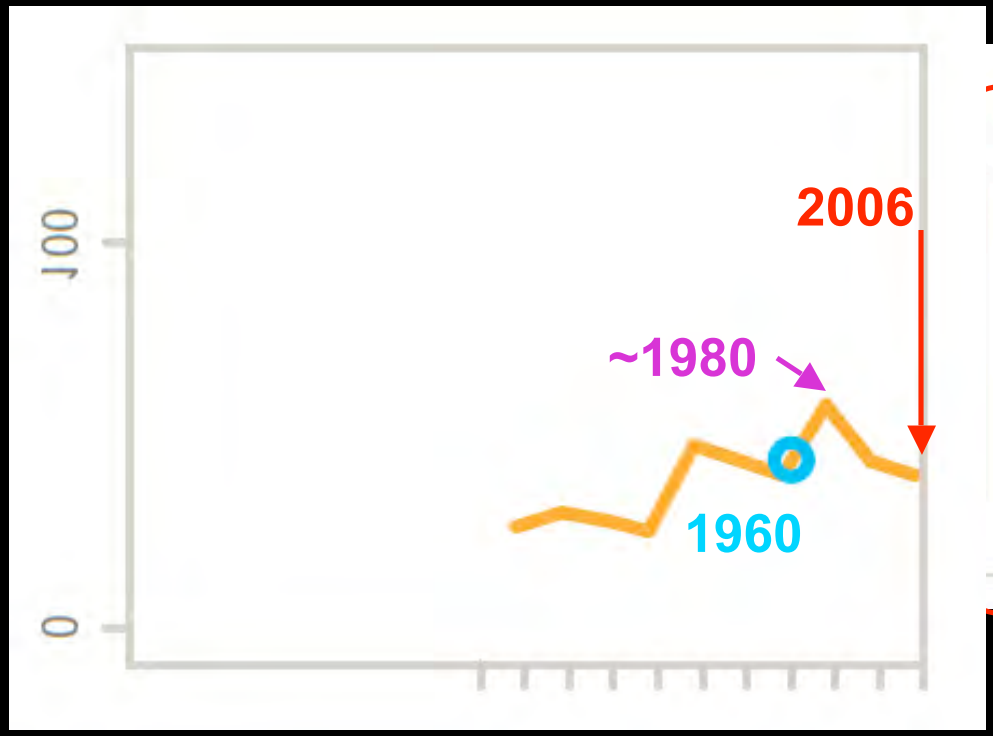
- USGS record of copper in South Bay

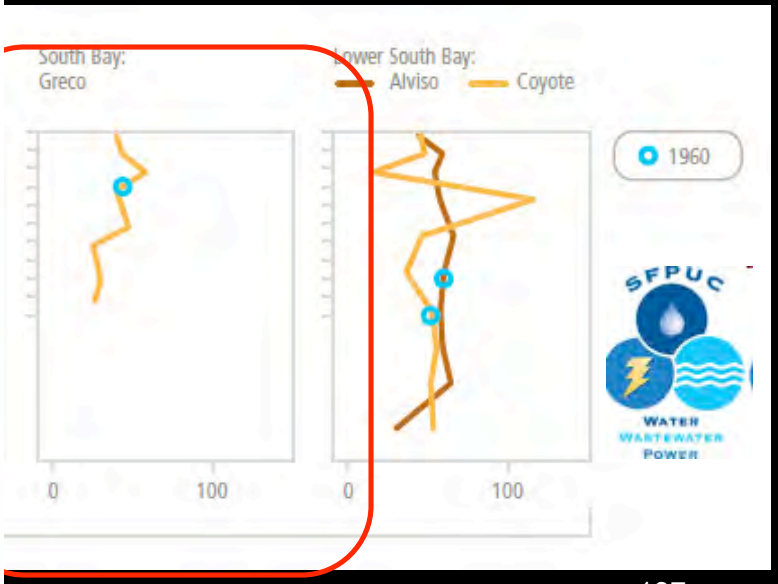


  – Surface sediments and clams max ~1980

Similar History in Cores

- Cu max ~1980s in South Bay wetland



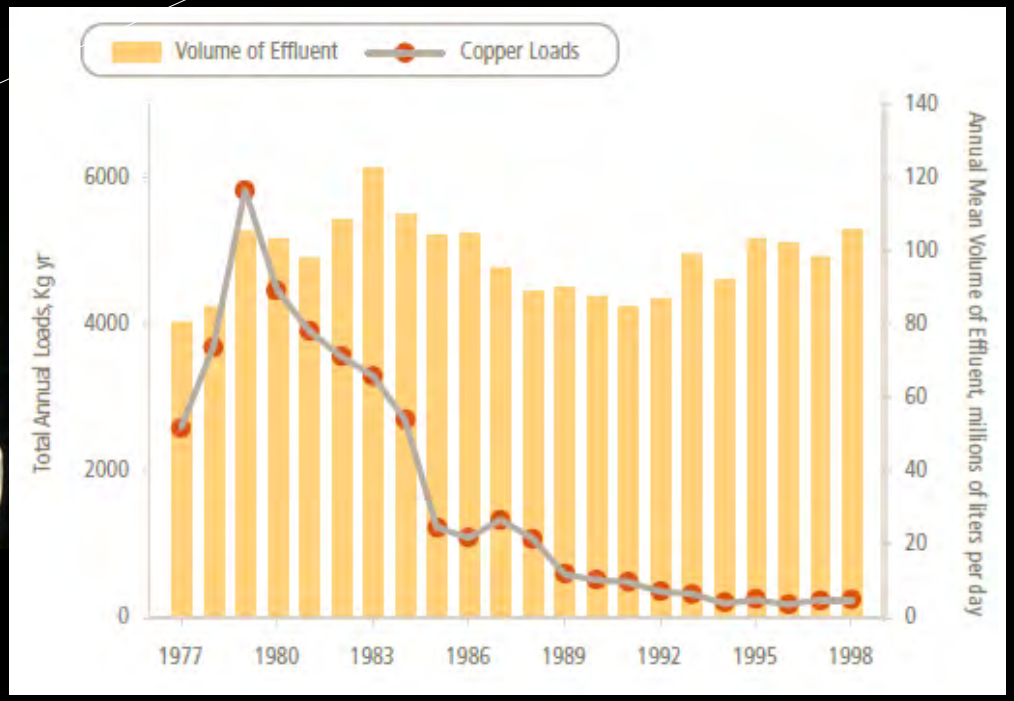


1960 estimated by ^{137}Cs

1980s: Cleaning Up Our Act

How did we get here?

(Clearly NOT the same as it ever was…)

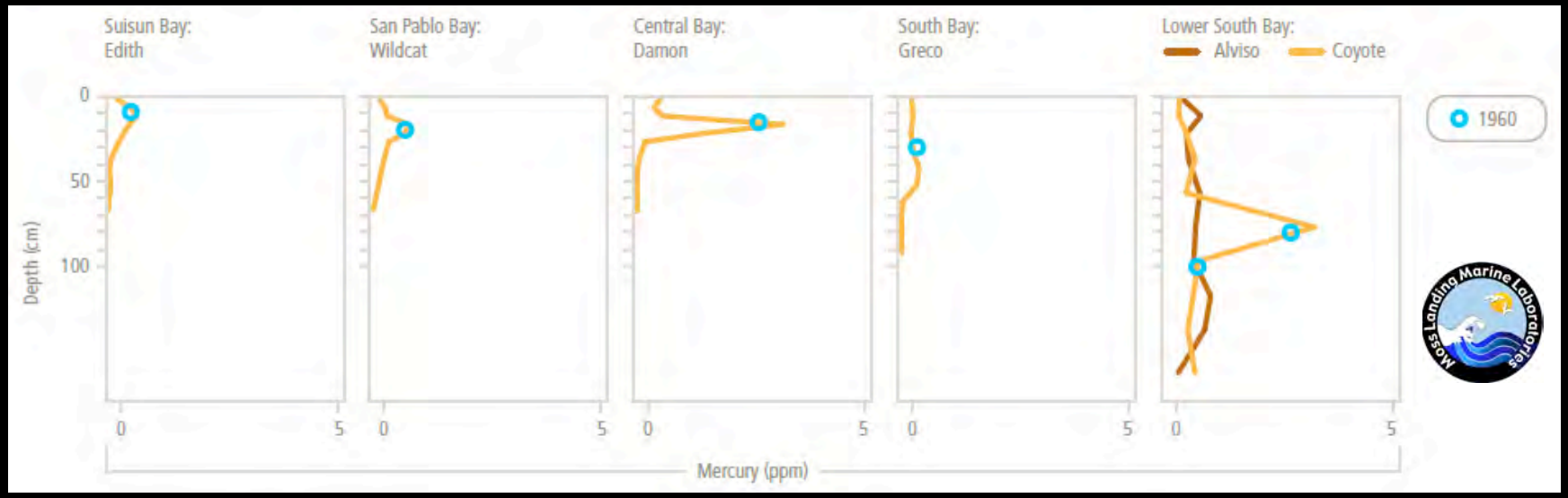


Palo Alto Loads 1977-1998

(Pre)treatment! (Remove Remove Remove Remove)

Our Dirty Past: Mercury

- Max in wetlands ~1960 or a bit earlier



1960 estimated by ^{137}Cs

- Where is the mercury from?

Blame… New Almaden?

Is It Really From Mining?

- New Almaden mining max late 1800s
- Last vestiges 1940s

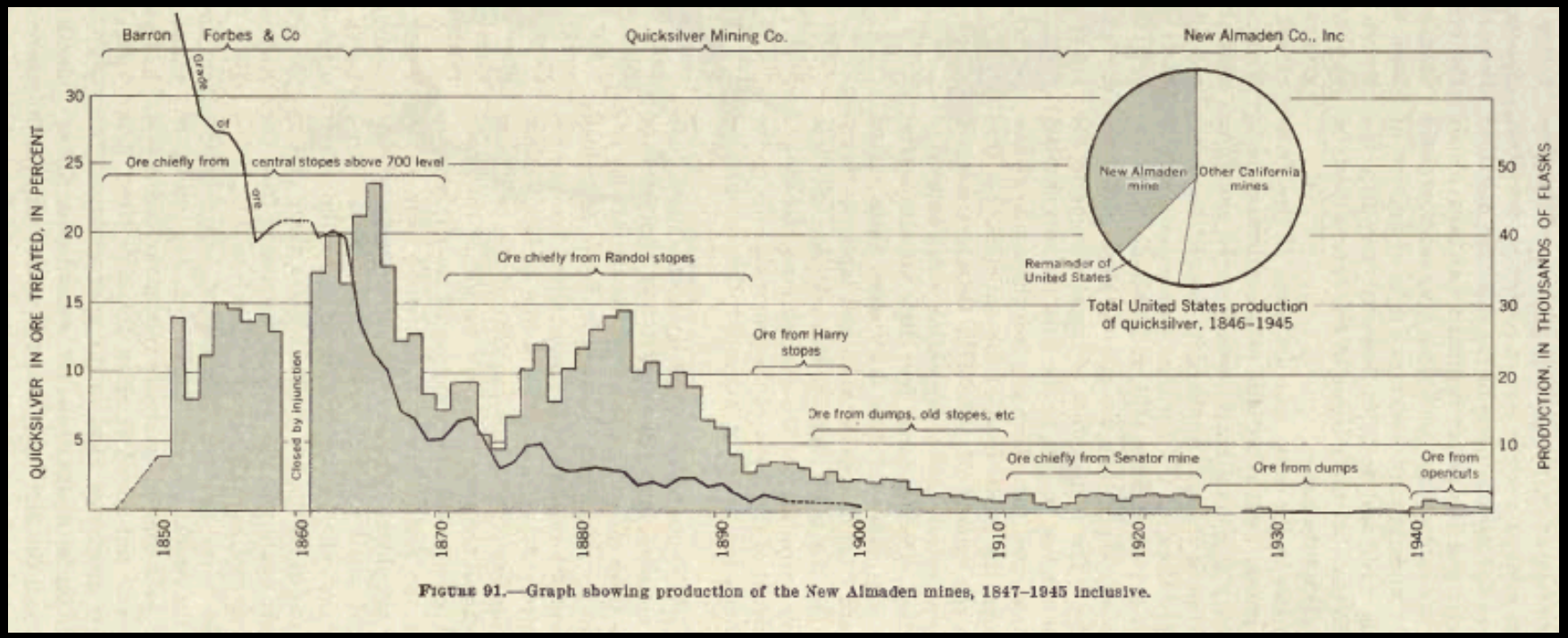


FIGURE 91.—Graph showing production of the New Almaden mines, 1847–1945 inclusive.

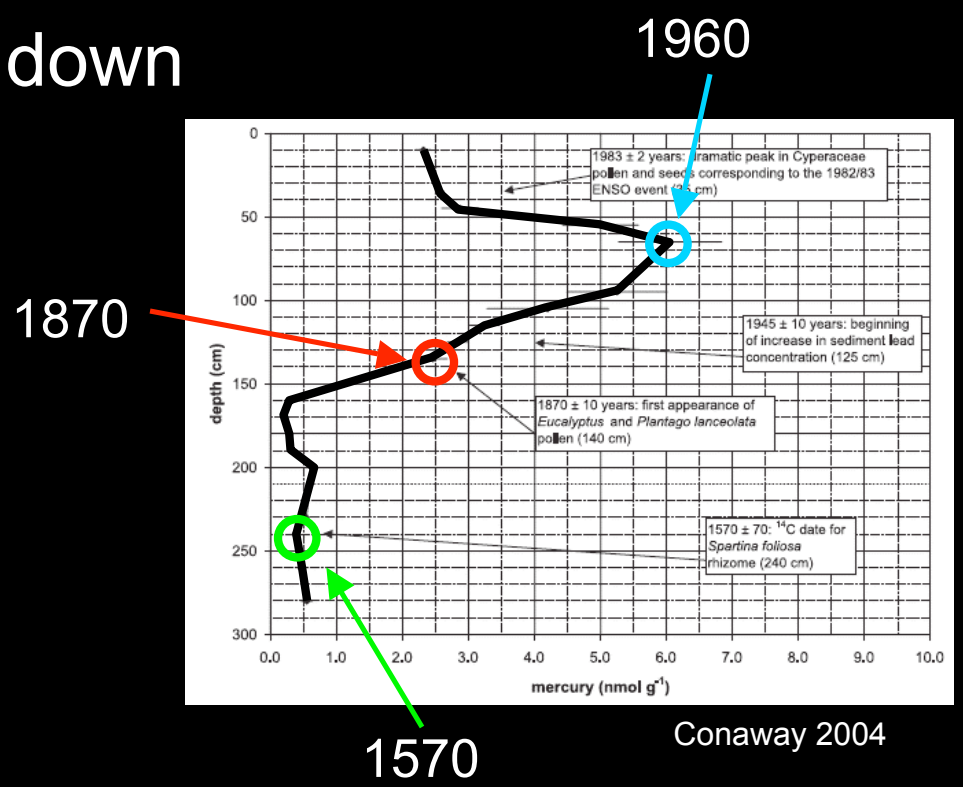
Bailey and Everhart 1964

Not-So-Quicksilver?

- Unlike wastewater Cu, mine Hg starts high in watershed, could….
  - take a while to get down
  - still be up there

or…

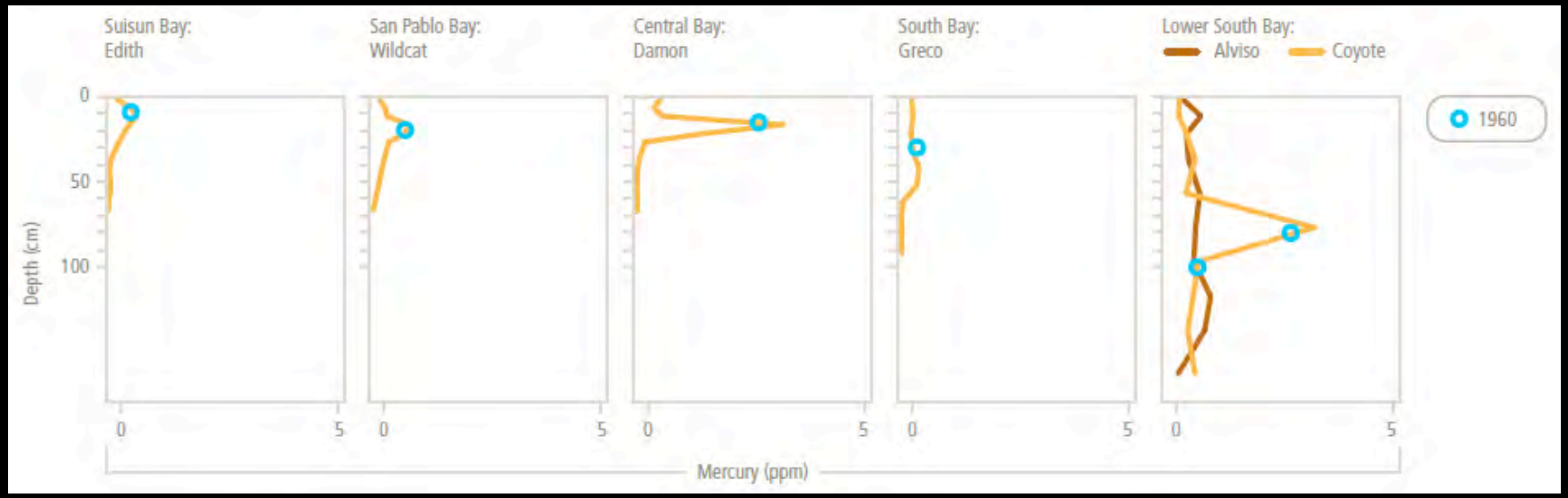
  - cores too shallow?
    - NO, 1870<1960 in previous study



Conaway 2004

Mines in Oakland??

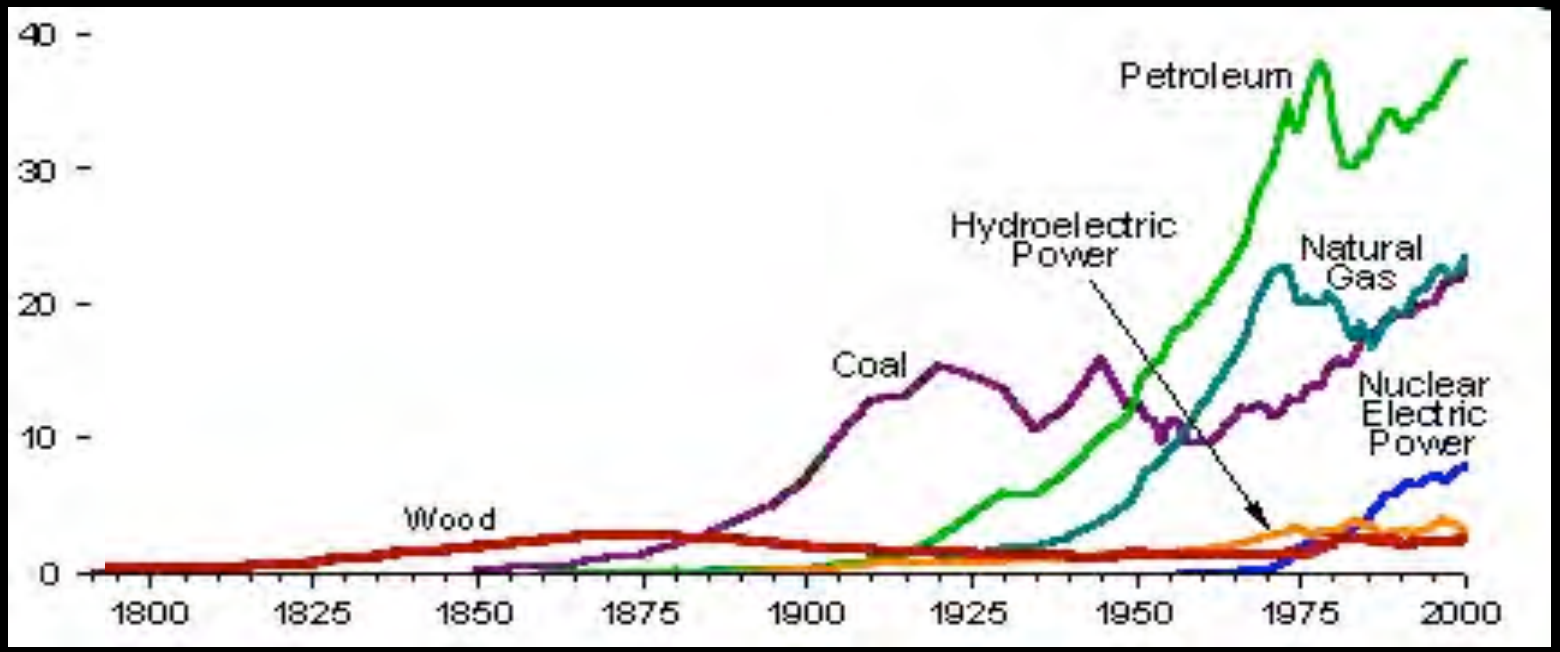
- If 1960 max from mining, why is Oakland (CB) ~ Coyote (LSB) > SB, SPB, SUB



- Alternative hypotheses?...

Old King Coal?

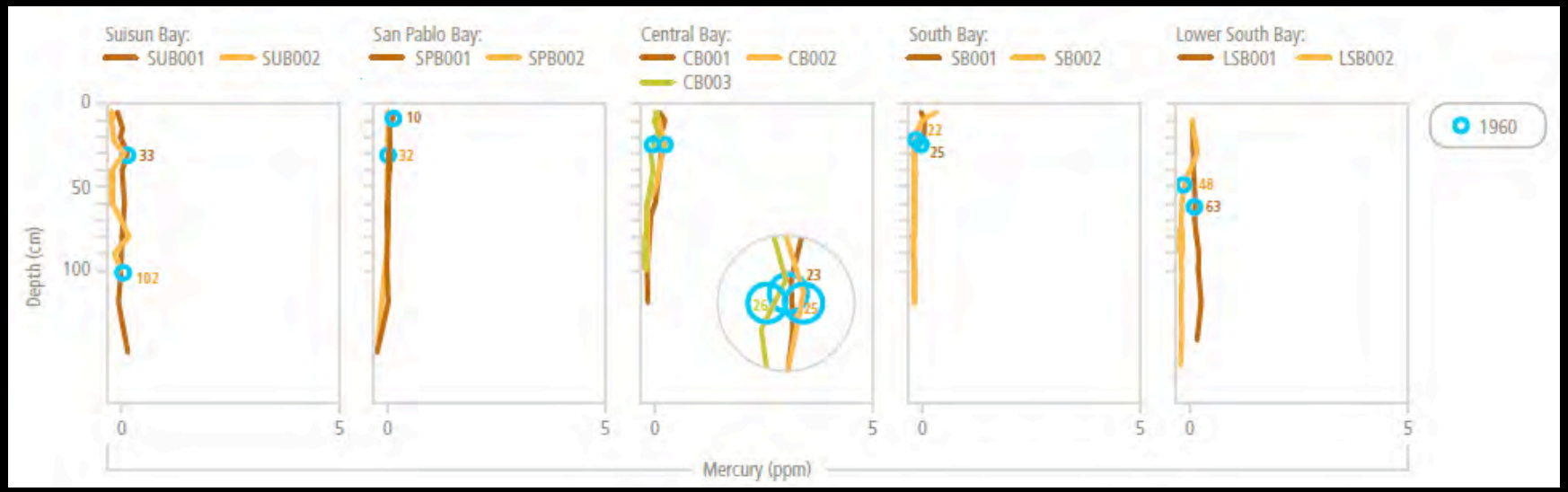
- Urban residential/industrial sources
- Temporarily peaked in 1940s
  - post 1970s use more centralized/controlled/treated



U.S. Dept of Energy

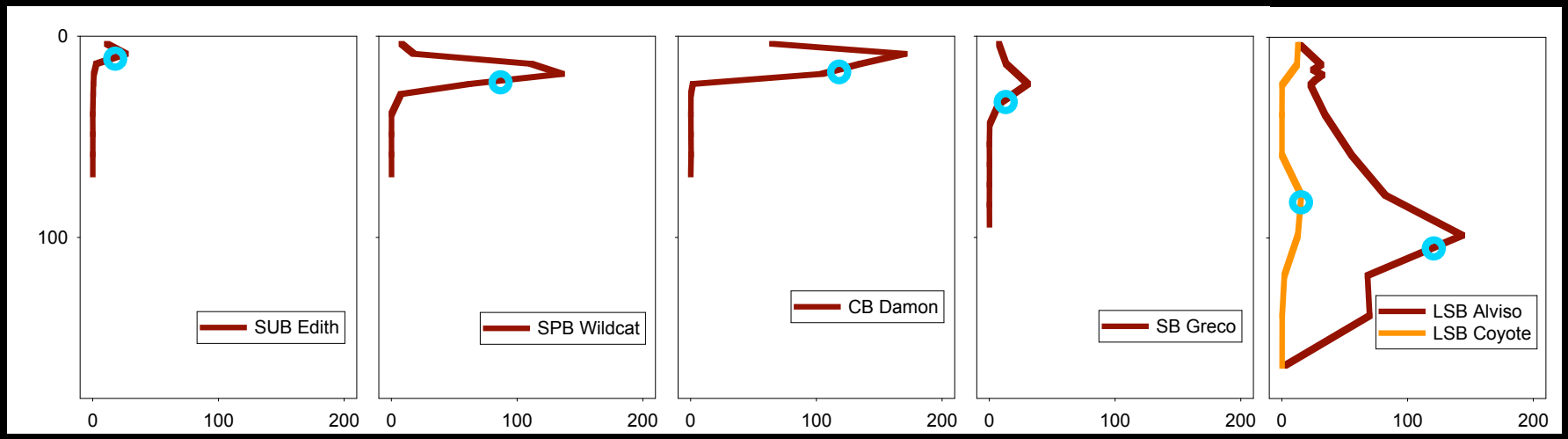
Same Patterns in Bay?

- Mostly not- comparatively flat, but deepest sections lower in Hg, Cu, etc.



Breaking News: PCBs*

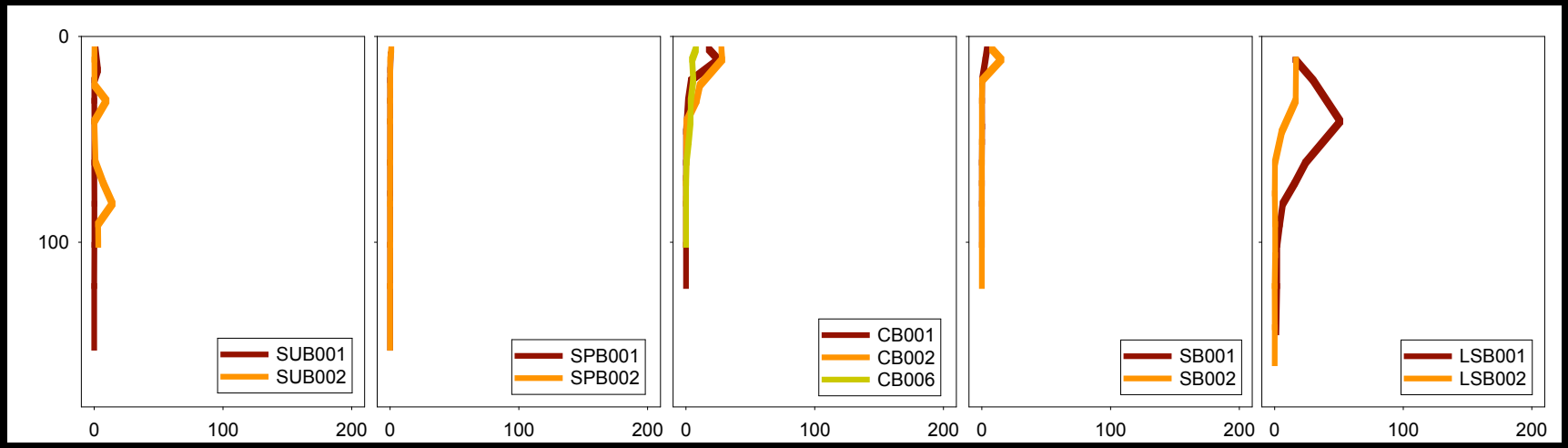
- Wetland max ~1980



* Preliminary results subject to revision. QA data not yet fully reviewed. Do not cite or quote. PCBs represents the sums of individual congeners reported by the RMP, including coeluters. Results shown may not be typical, consult with your doctorate before proceeding on any program of action.

Breaking News: PCBs*

- Bay max much smaller



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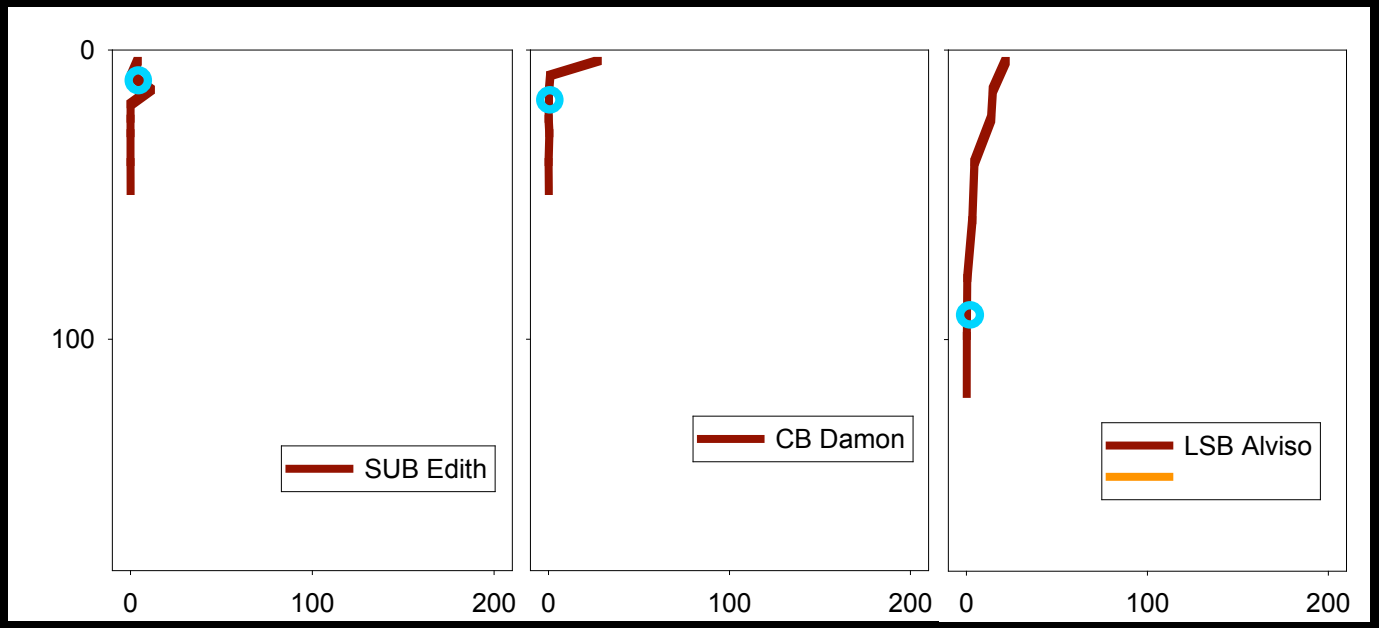
Tomorrow's Breaking News: Wetland PBDEs*

- Wetland max at surface



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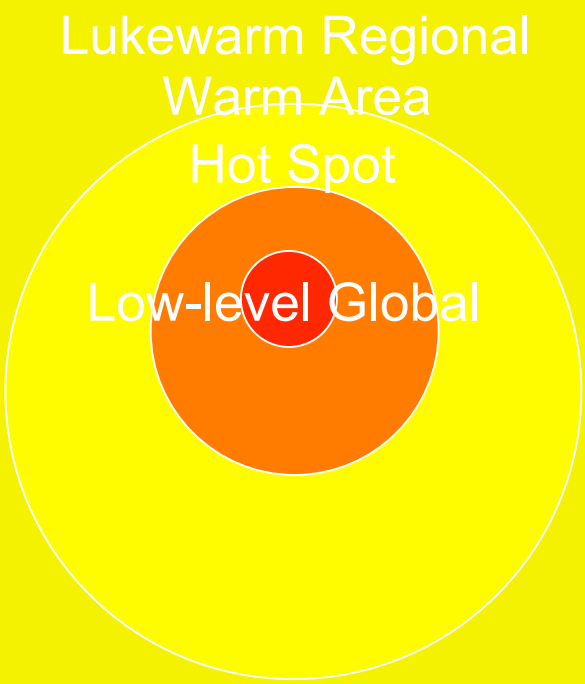
Good News / Bad News

- Good news-
  - Few nasty surprises in Bay (only 4 of >100 sites have large subsurface max)
  - Mostly near current surface concentrations
- Bad news-
  - Not for lack of/constant sources
    - wetland cores show otherwise

Where have all the time bombs gone?

Already Blown Up?

- Bay mixing, erosion spread pollutants
- Dilution to “safe” levels slow, if ever



Proverbs Re-Learned

Don’t wait until the horse has bolted to close the barn door.

A stitch in time saves nine.

Turn off the faucet before mopping the floor

R. Hoenicke

An ounce of prevention is worth a pound of cure.

B. Franklin

An ounce of prevention
is worth a TON of cure.