SF Bay Cores Update

RMP TRC Meeting March 2009

Background

- USGS (1990) coring
  - 90+ sites screened only
  - 2 depositional sites fully characterized
  - Subsurface max @ 2 sites
    - Pollutant reservoir?
- Why Recore?
  - 2 of 90 sites probably not representative
  - Old cores unusable for chem analyses

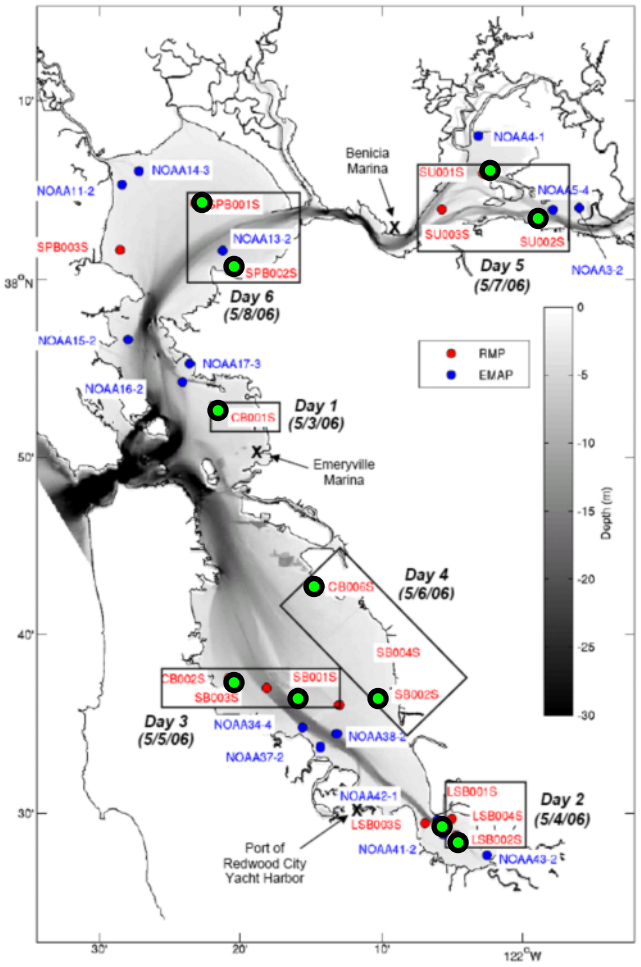
Core- What Is It Good For?

(absolutely something)

- Bay pollutant inventory
  - Erosional time bombs?
- Model validation
  - Conceptual &/or mechanistic
- Model development
  - Empirical, mechanistic, hybrid

Distribution of Sites (Bay)

- Representative
  - inventory, sedimentation
- 3 sites Central Bay, 2 sites each other segments
- Preference to RMP repeat stations



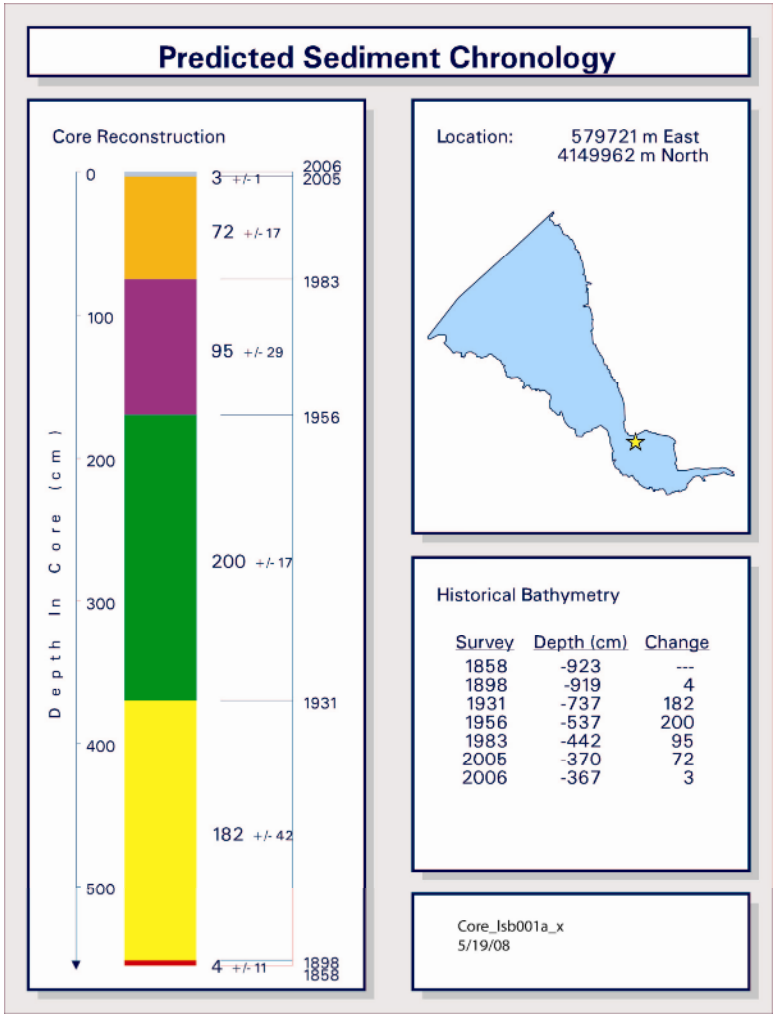
Distribution of Sites (Wetland)

- Loading history
  - Depositional zones
- 1 site each segment
  - Pt Edith Martinez
  - Wildcat Richmond
  - Damon Sl. Oakland
  - Greco Island
  - Coyote Creek
  - Alviso Marina

Conceptual Model

- Sedimentation (from isotopes, bathymetric history)
  - Similar in segment (shared water, sediment)
  - But mesoscale differences (trib/shore proximity, etc)
- Pollutant distribution function of
  - Sedimentation history
  - Local land use/ loading

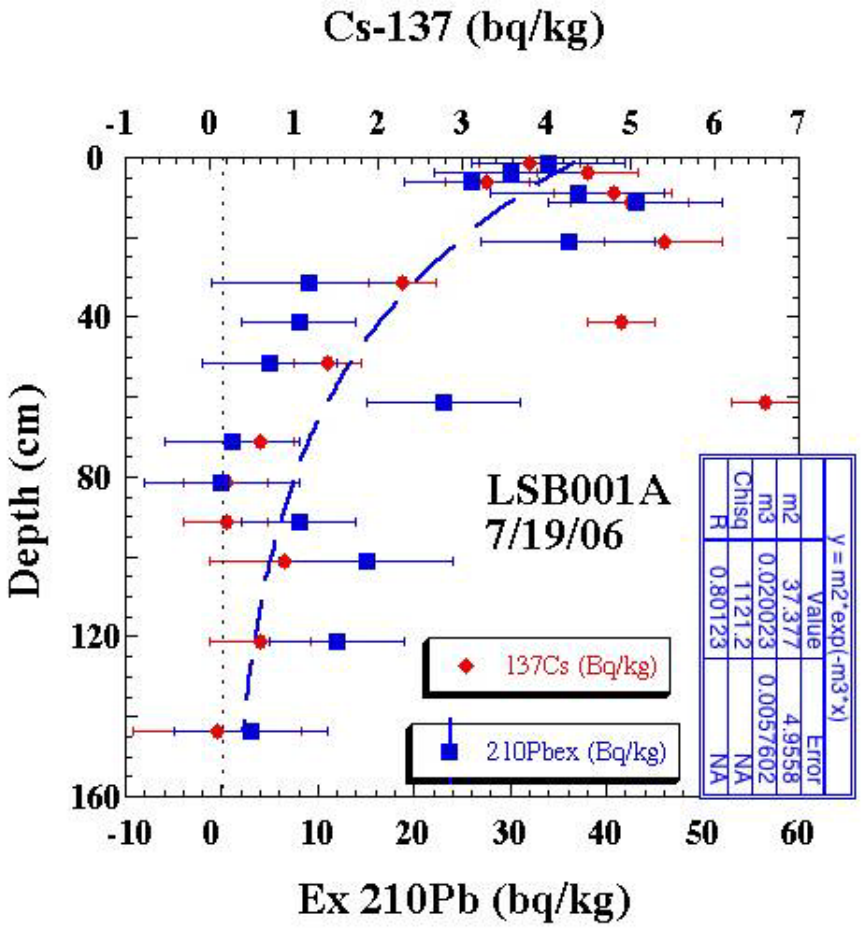
Dating: Bathymetric History



(USGS Bruce Jaffe)

- Sum bathymetric changes between surveys
  - + deposition – erosion
- Some sites depositional & erosional different periods

Dating: Isotopes



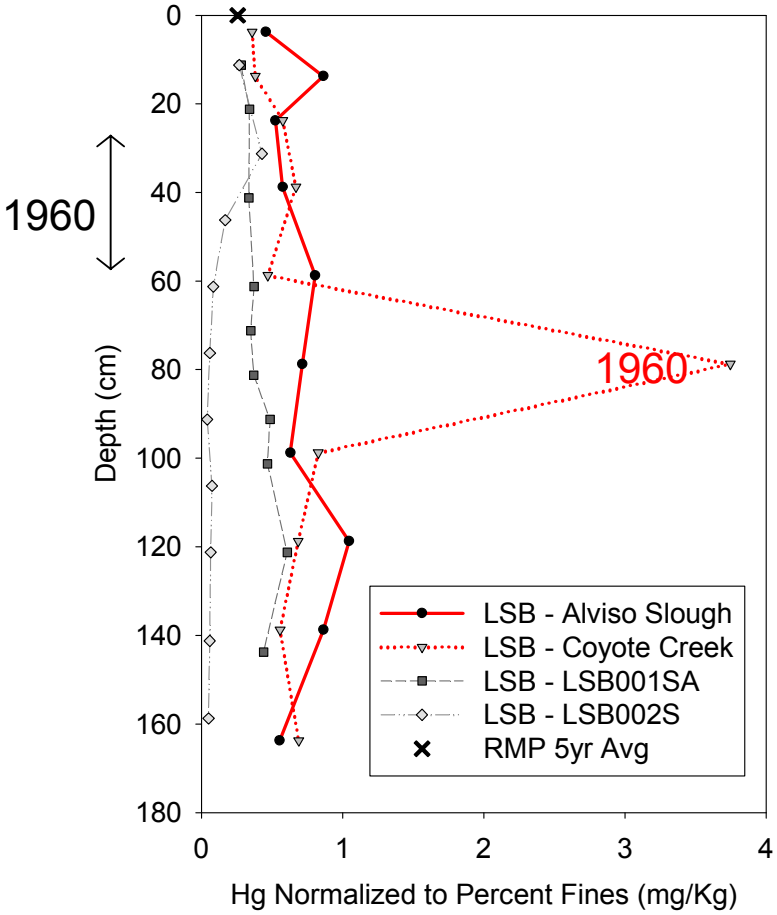
- (USC Hammond)
- Cs in A-bomb
  - max ~1960
- Pb decay
  - half life 22 yrs
  - Decay/ mixing dilution can look similar
- If Cs & Pb similar
  - likely mixing dilution

Results

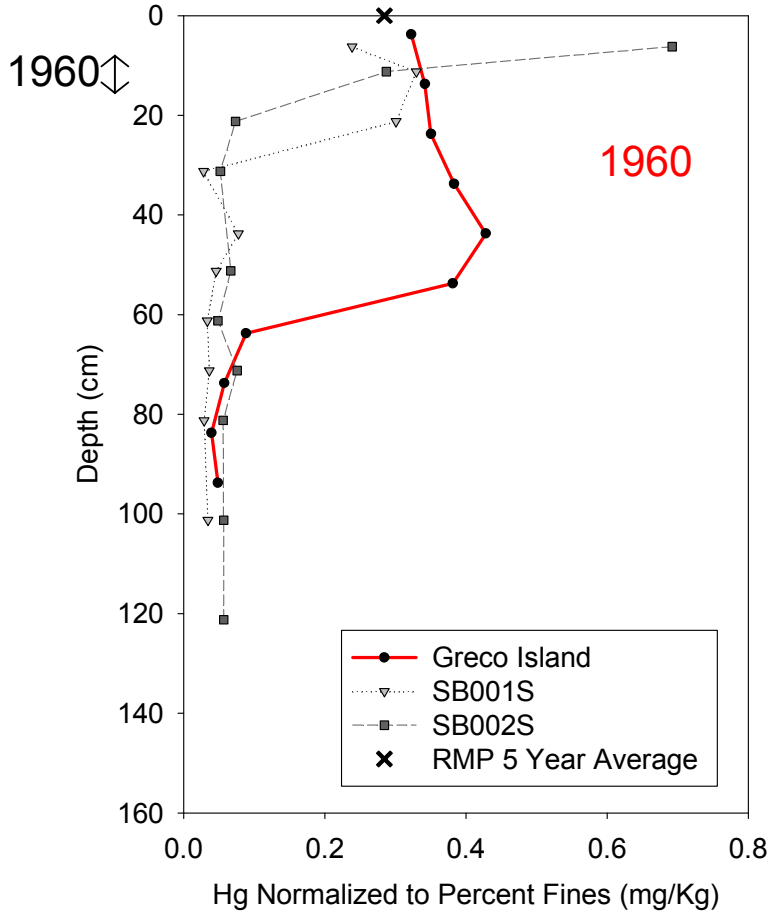
- Sites within segments similar (from bathymetry and radiodates)
  - Suisun, San Pablo eroding
  - Central, South neutral/eroding
  - Lower South accreting
- Wetland Hg indicates loading history
  - Subsurface max in wetlands everywhere
  - Layer often near surface (1950s?)

Lower South / South Bay

1960 = 30-60cm bay, 80cm wetland

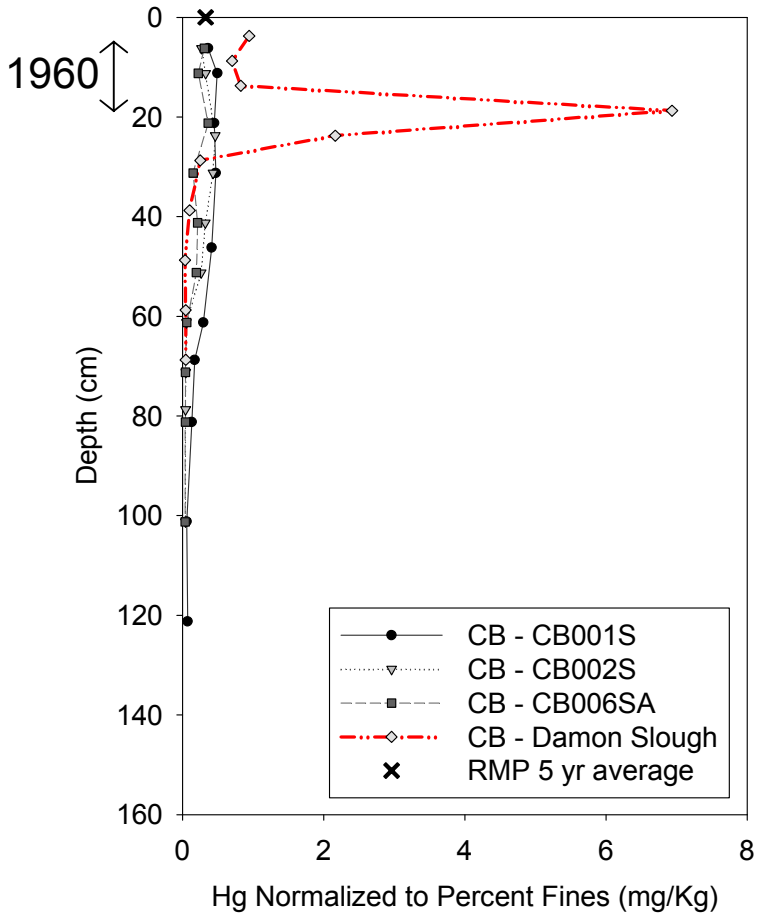


12-15cm bay, 30cm wetland



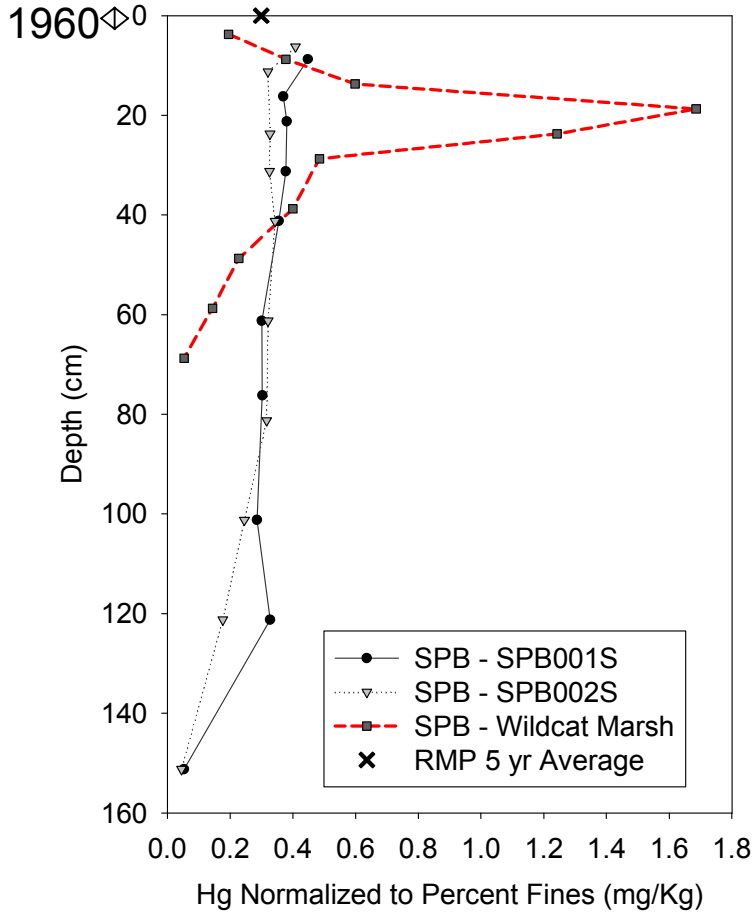
Central Bay

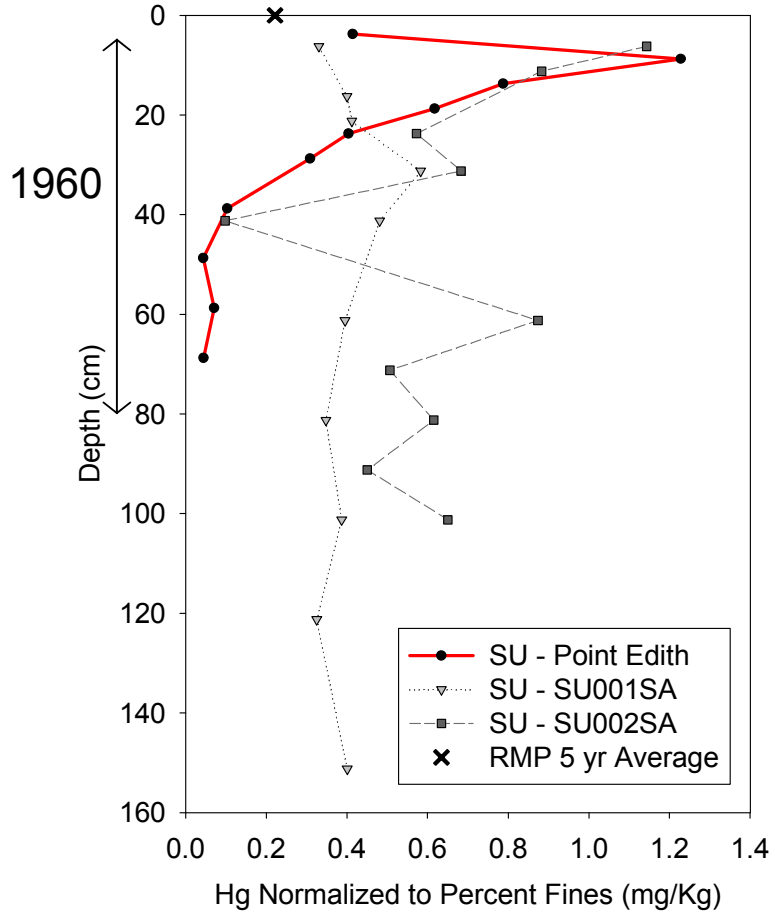
1960 = 5-20cm bay, ?? wetland



San Pablo & Suisun Bay

1960= 2-5cm bay, ??wetland 2-80cm?! bay, ??wetland





Results

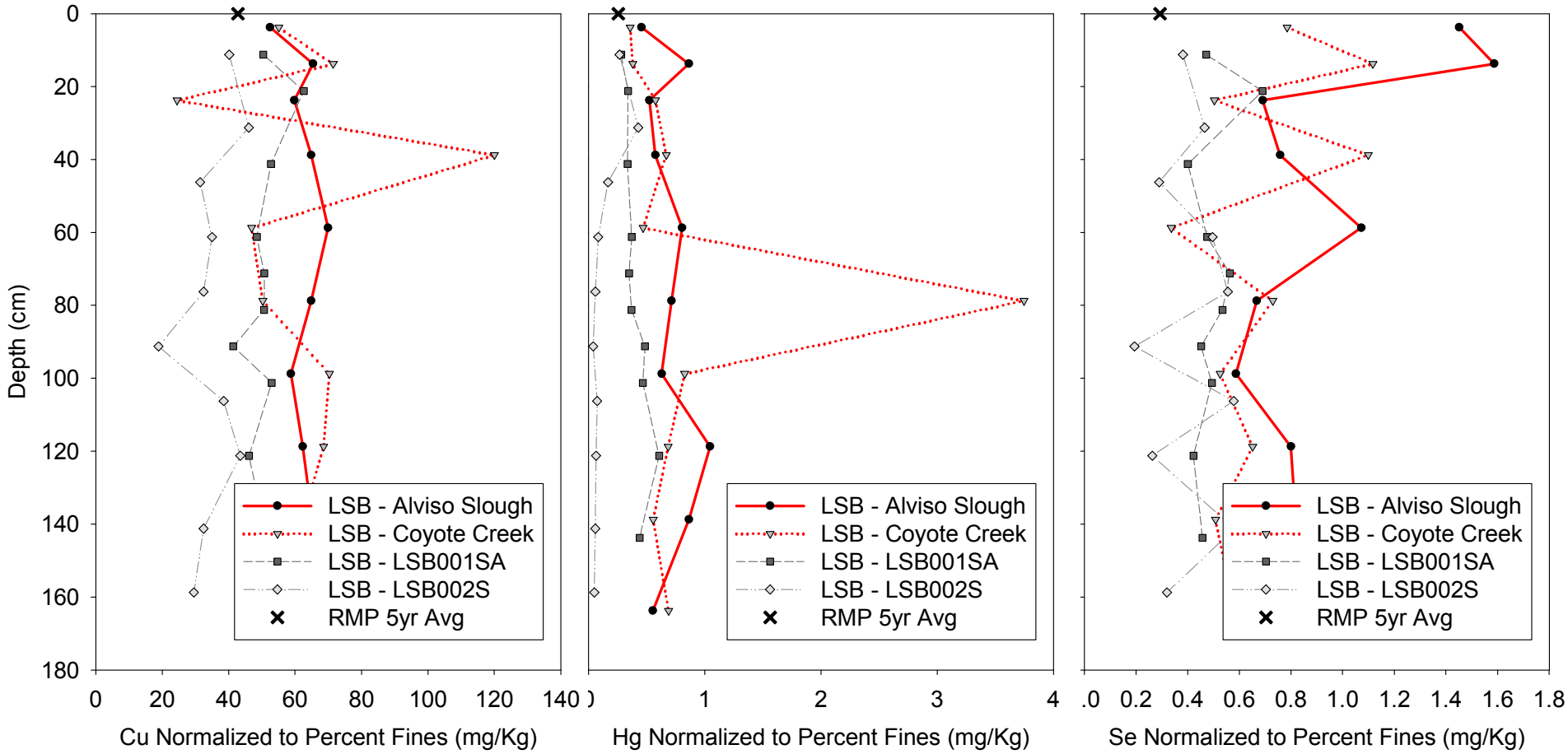
- Bay core Hg often ~uniform, or complex
  - RMP segment avg ~ core top section
  - Weak/no subsurface max in Bay sites
  - Mixing, erosion (or ~constant loads)?
    - All could give ~uniform profile
  - Some sites not well predicted (esp SU002)
    - Bathymetry, Cs, Hg mismatch
    - Multiple deposition & erosion w/ seds from different watersheds

Implications?

- Few Hg ticking time bombs in Bay
  - So far, so good (2 of [90 + 11])
  - Largely WYSIWYG (surface ~ middle)
- Wetland cores capture historical pulses
- Historical Hg loads mostly eroded, dispersed in Bay

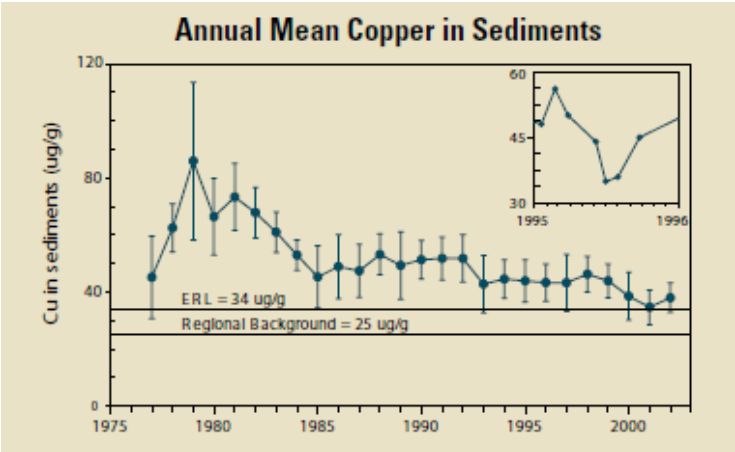
Lower South Bay

1960 = 30-60cm bay, 80cm C.Creek



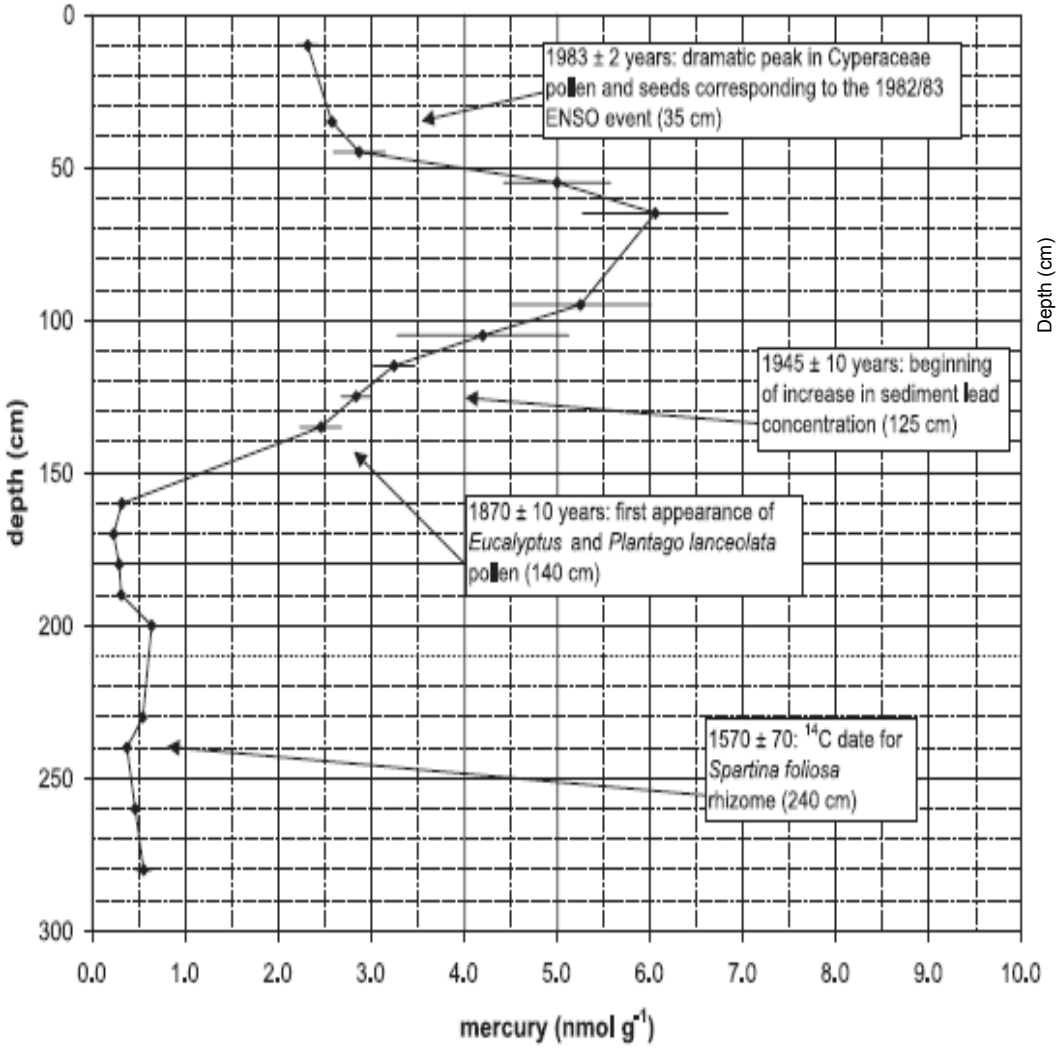
LSB Metals

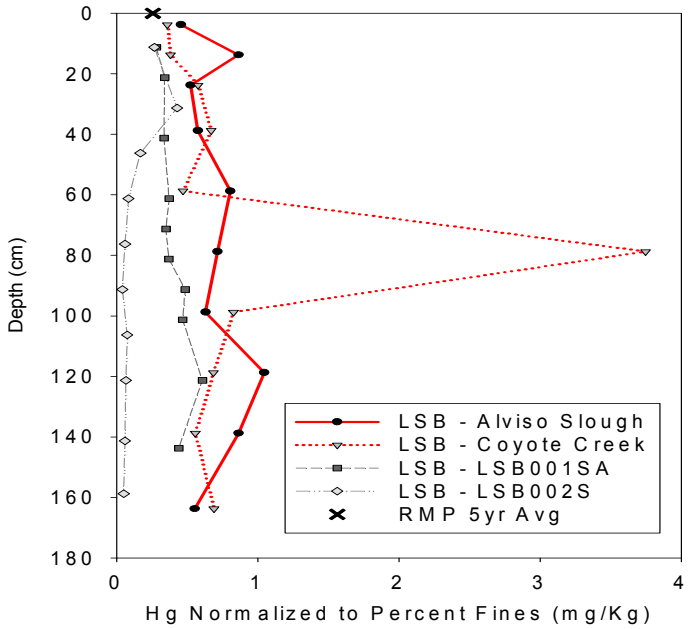
- Downcore concentrations noisy
  - Coyote Creek Hg max > Alviso!
  - Coyote Hg max @ 1960s depth (80cm)
  - Coyote Cu max @ 40cm = 1980s?
    - ~max Cu discharge late 1970s (Palo Alto)



    - ~surface sediment Cu USGS long term data

Conaway 2004 vs Current

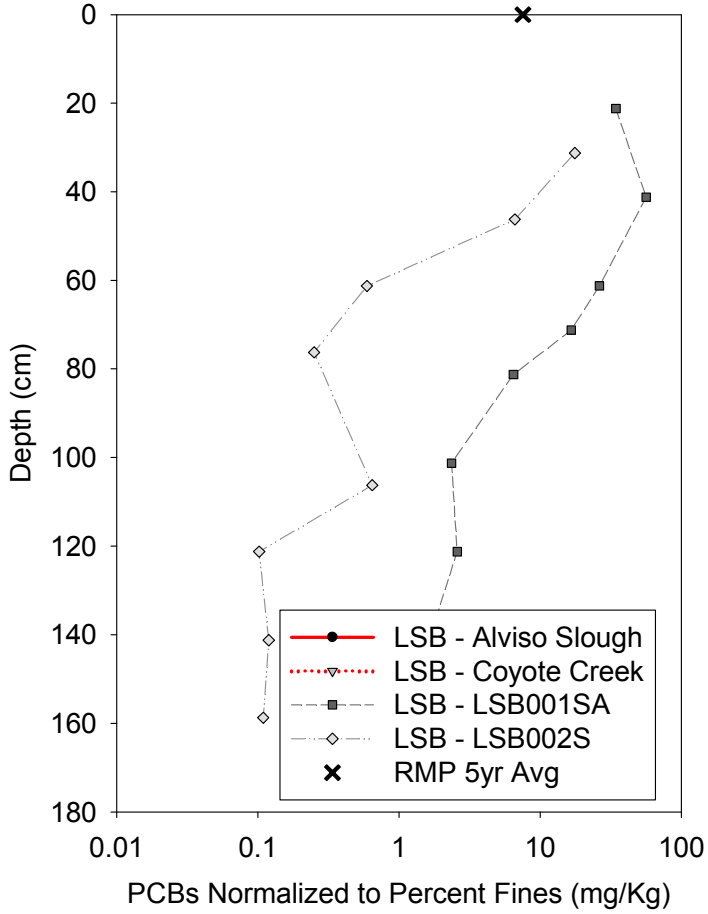




5nmol/g ~ 1mg/kg

Lower South Bay PCBs

- PCB in bay cores max subsurface
  - LSB001 max @40cm (60cm =1960)
  - LSB002 max @30cm (30cm = 1960)



Next Steps

- Finish wetland radiodating (April)
- More normalization? (high TOC in wetlands)
- Model accretion vs mixing for isotopes (USC)
- Understand data discrepancies
  - Analytical variation, spatial/temporal differences
- Implications for other work
  - More coring, modeling
- Partial (Hg) report for Pulse of Estuary
  - All done 2009 Q3?

LSB Metals

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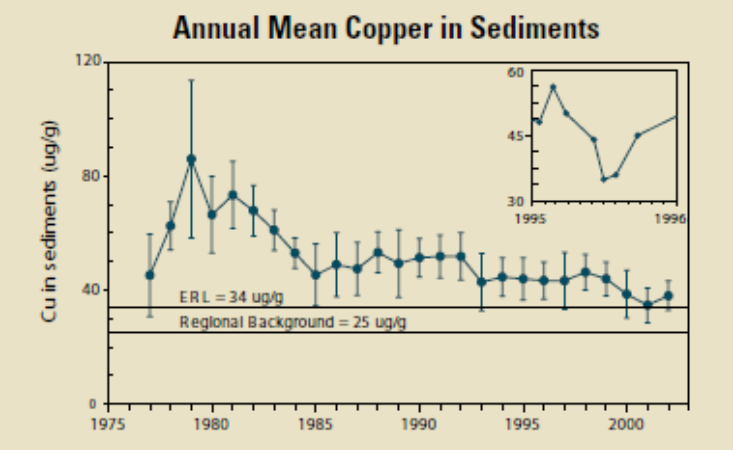
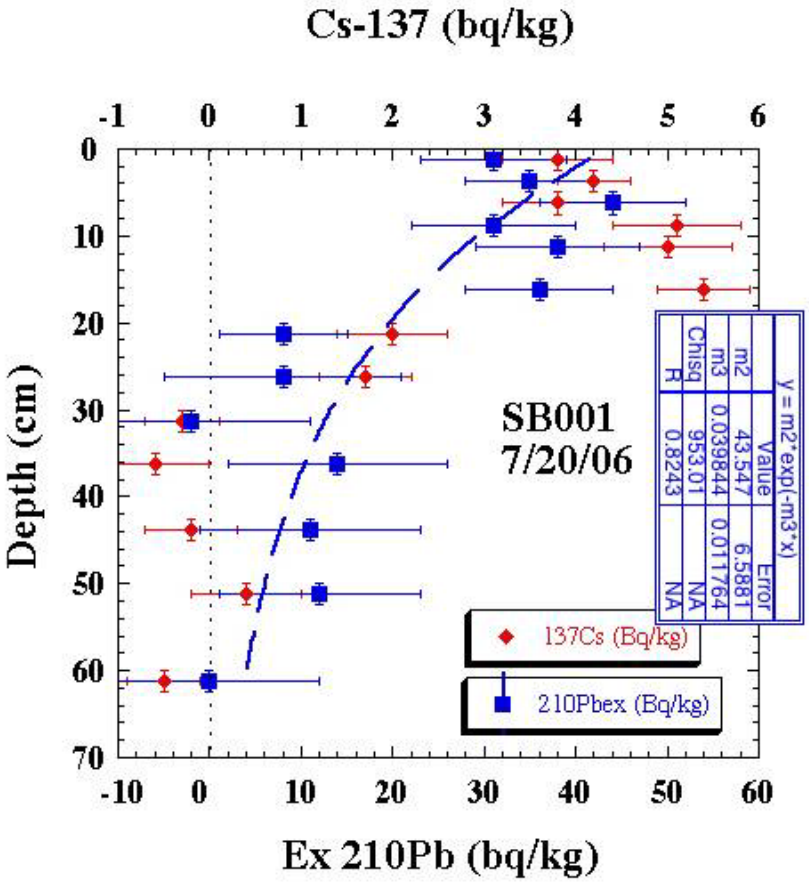


    - ~surface sediment Cu USGS long term data

SB001: Continuous Erosion?

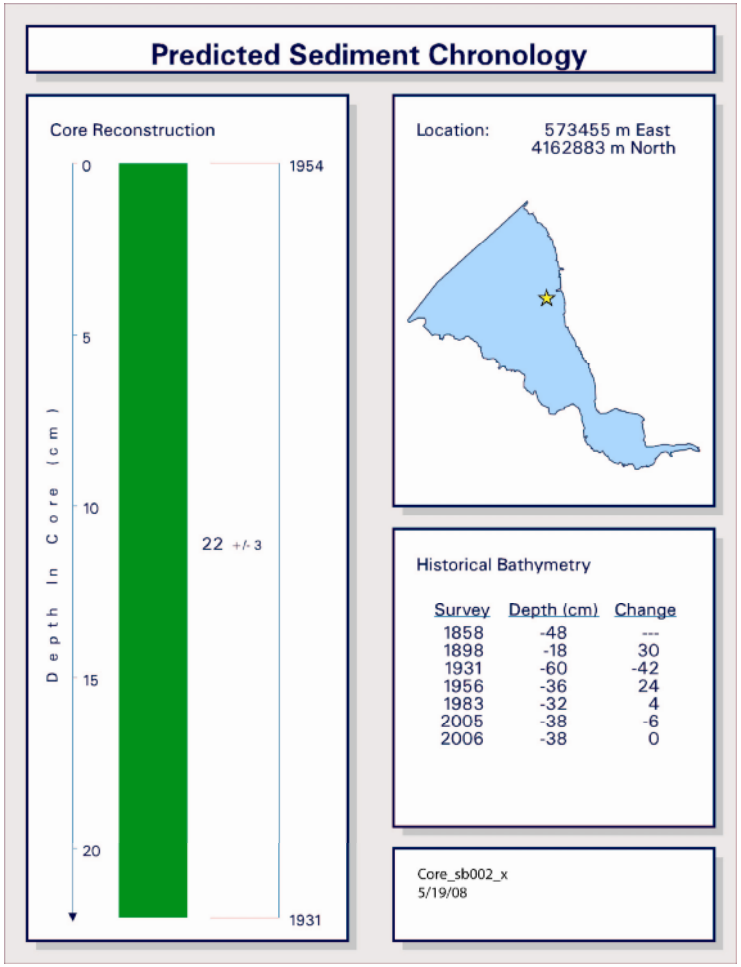
Core ID: SB001,
X: 564867.30345800000,
Y: 4163027.61900000000
1858 depth: -122
1898 depth: -123
1931 depth: -157
1956 depth: -124
1983 depth: -146
2005 depth: -160
2006 depth: -161
Reconstructed horizons: 0



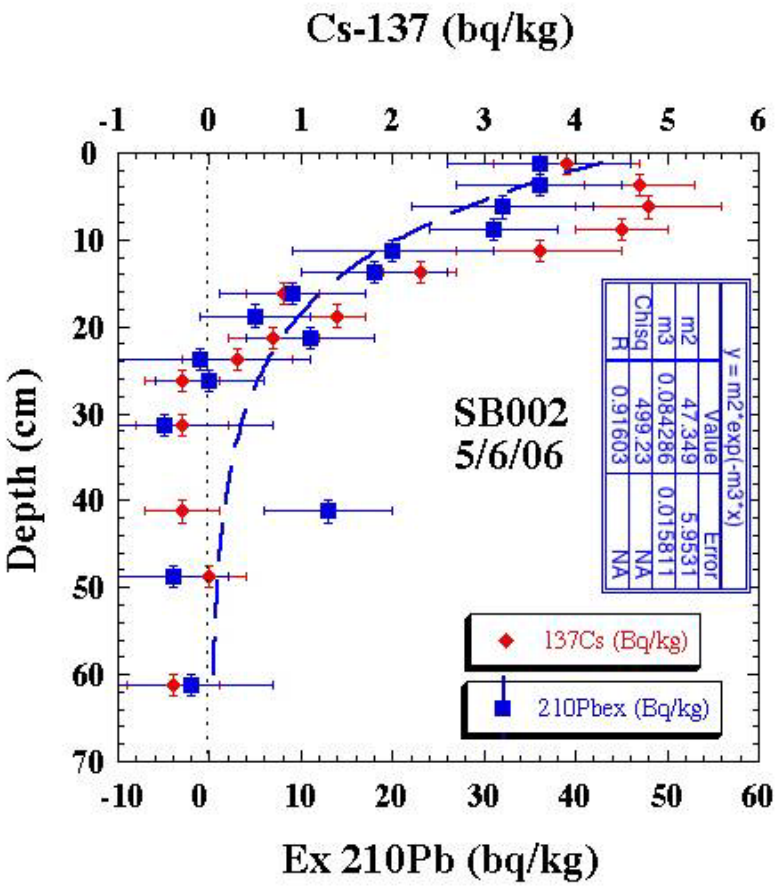
~0cm to 1960

~15cm to 1960

SB002: No Change ~1950s

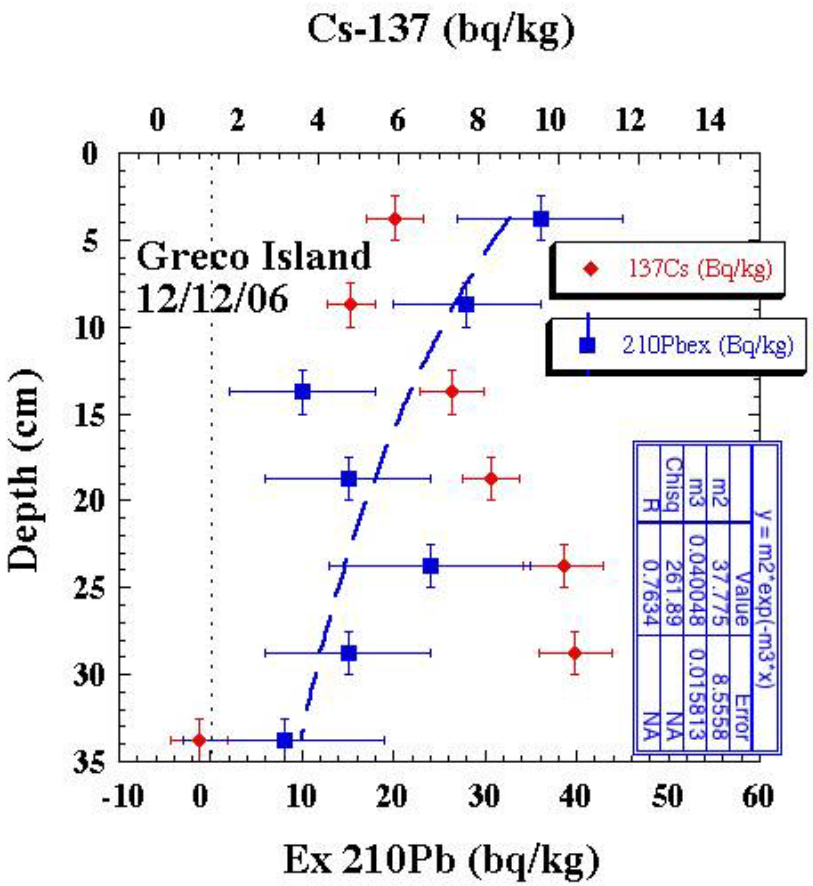


~0cm to 1960



~12cm to 1960

SB Wetland Deposition

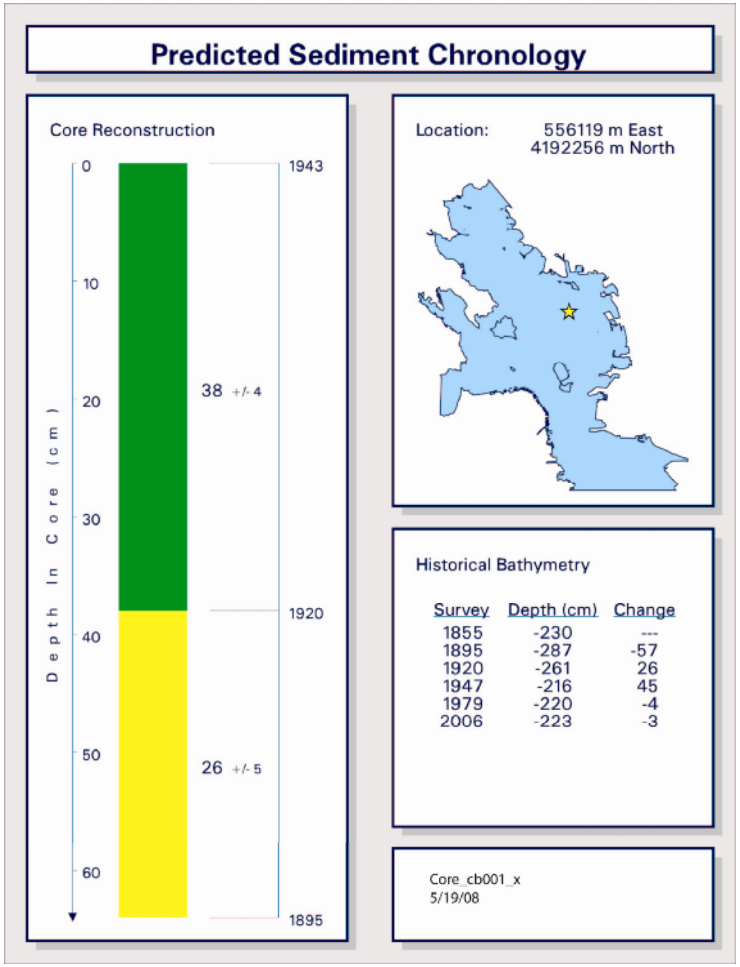


~30cm to 1960

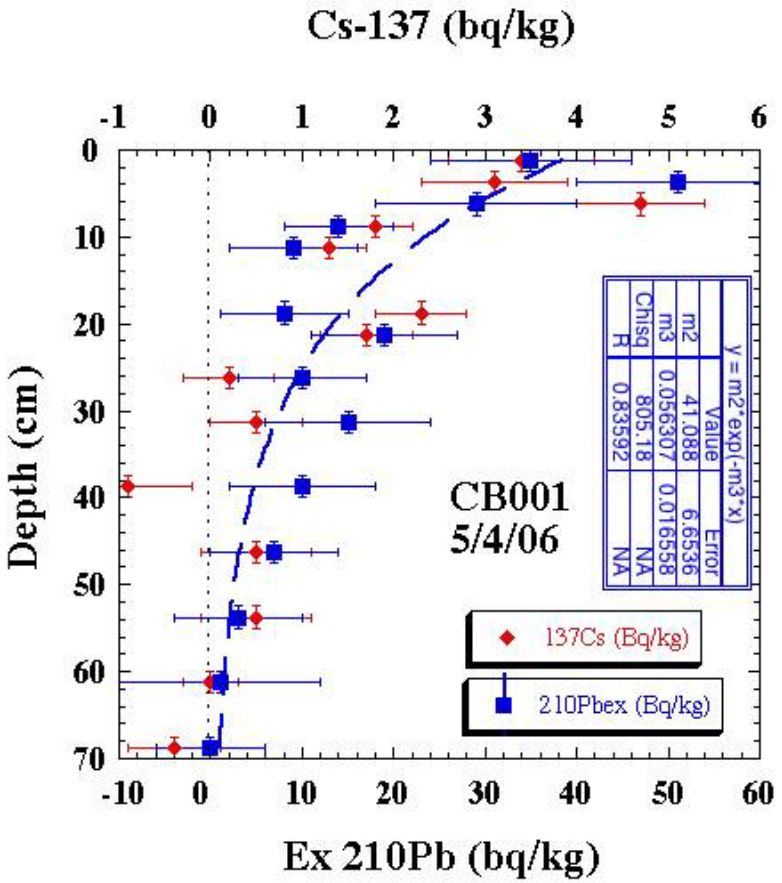
South Bay Metals

- Downcore concentrations noisy
  - Cu max @ Greco Island similar to Coyote, but into 1960s zone.
  - Greco Hg max ~constant in wetland to 55cm (1960s Cs penetration to 30cm) = 1930s?

CB001: No Change ~1940s

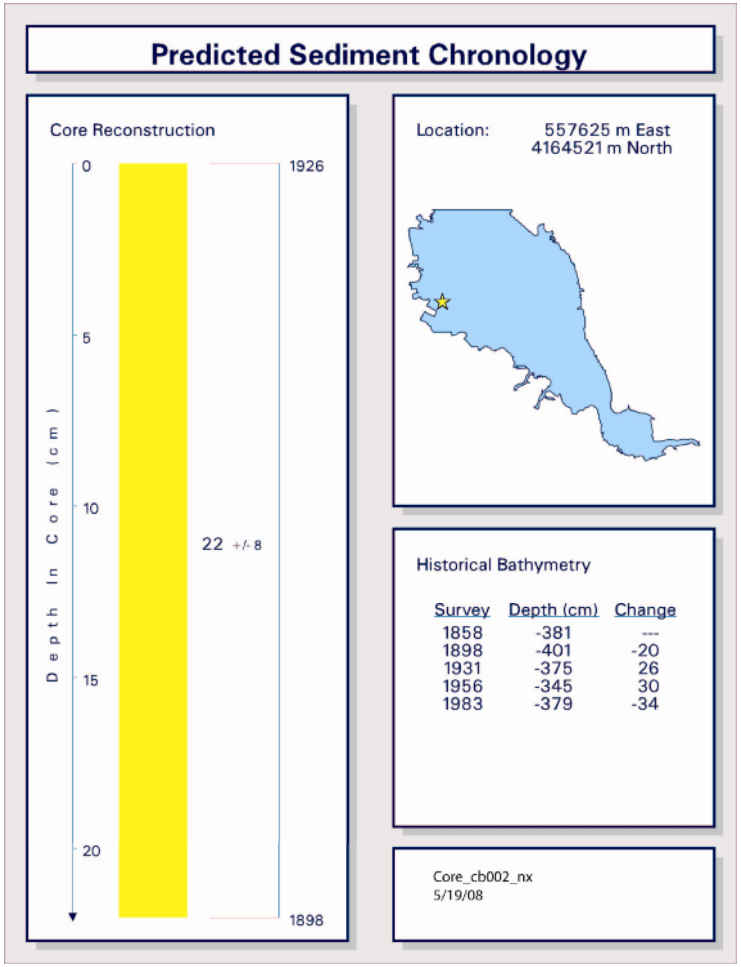


~0cm to 1960

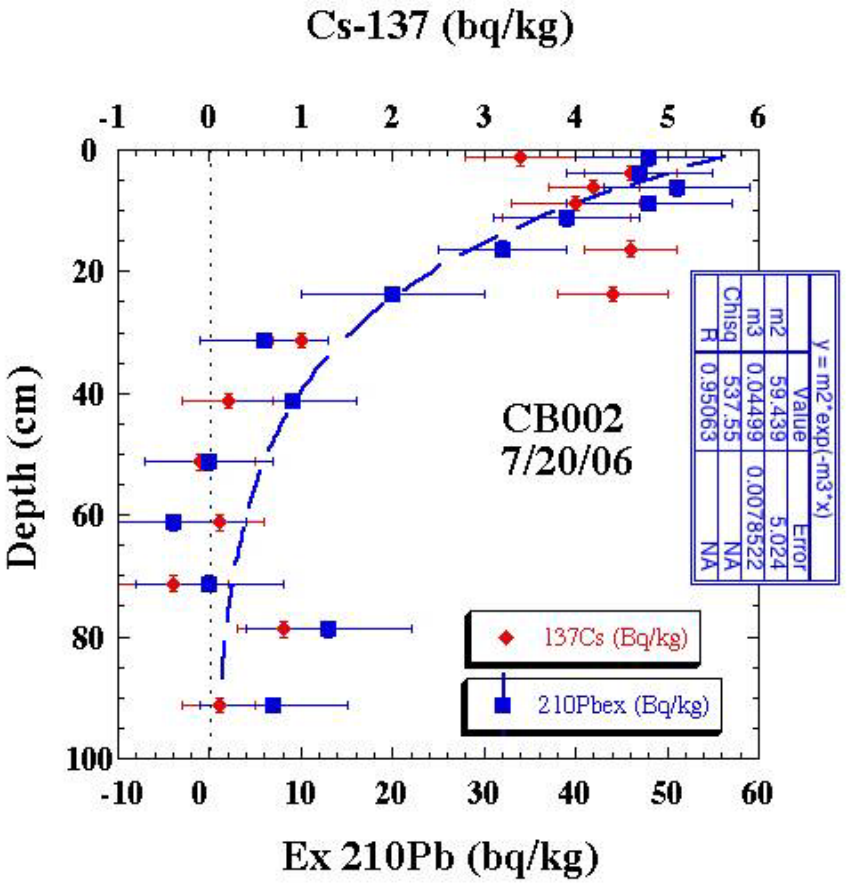


~5cm to 1960

CB002: Erosion to ~1920s



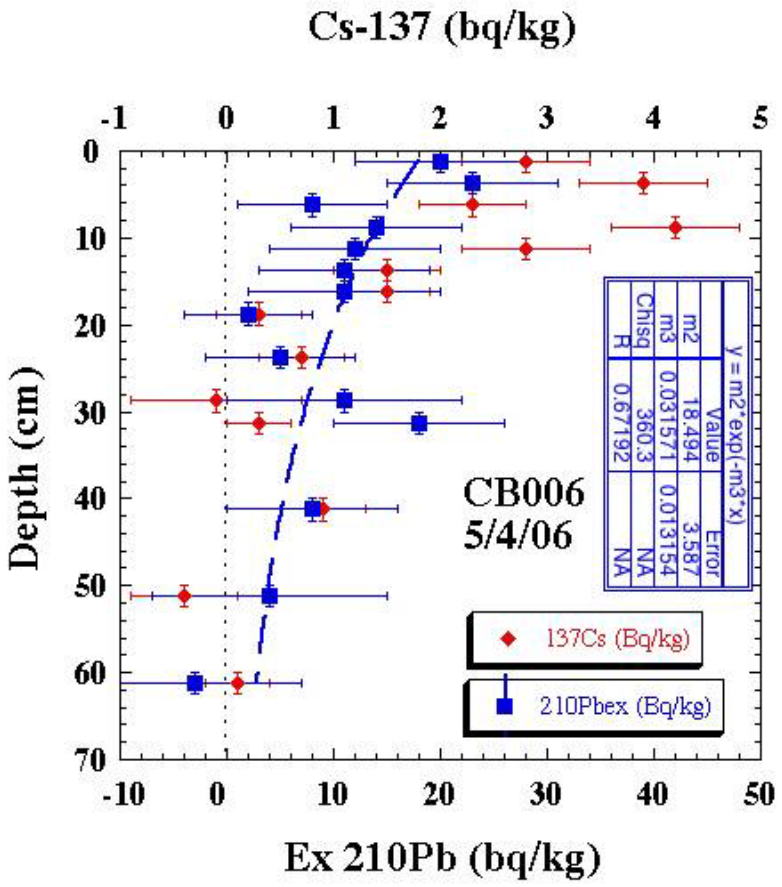
~0cm to 1960



~20cm to 1960

CB006: Continuous Erosion

Core ID: CB006A,
X: 566290.21976900000,
Y: 4174242.03589000000
1858 depth: -106
1898 depth: -134
1931 depth: -132
1956 depth: -183
1983 depth: -220
Reconstructed horizons: 0



~0cm to 1960

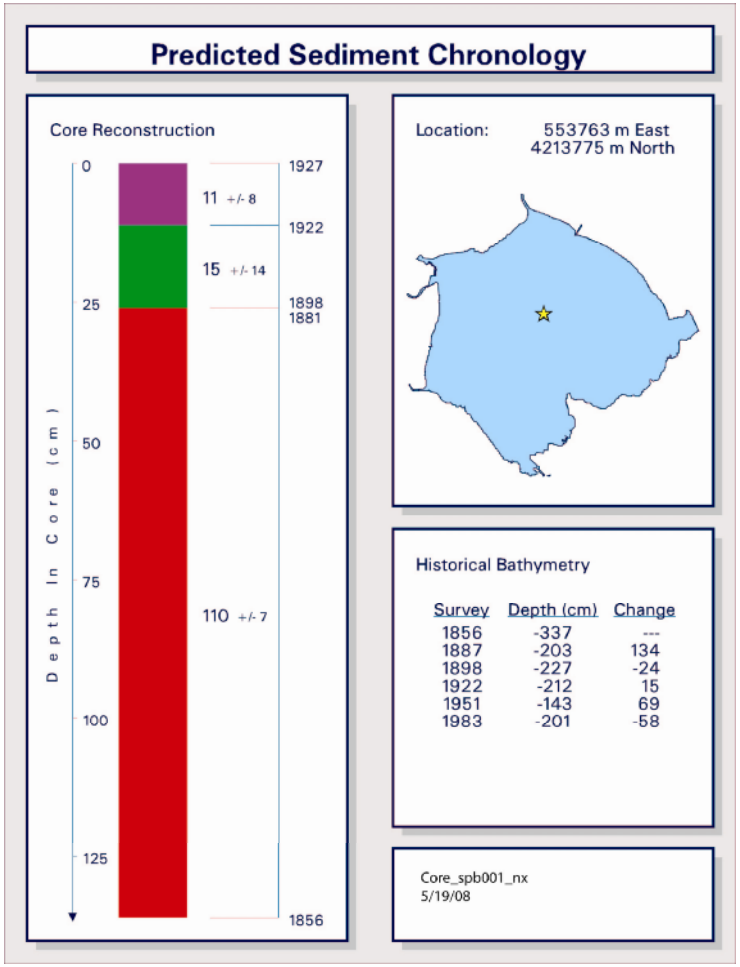
~12cm to 1960

Central Bay Metals

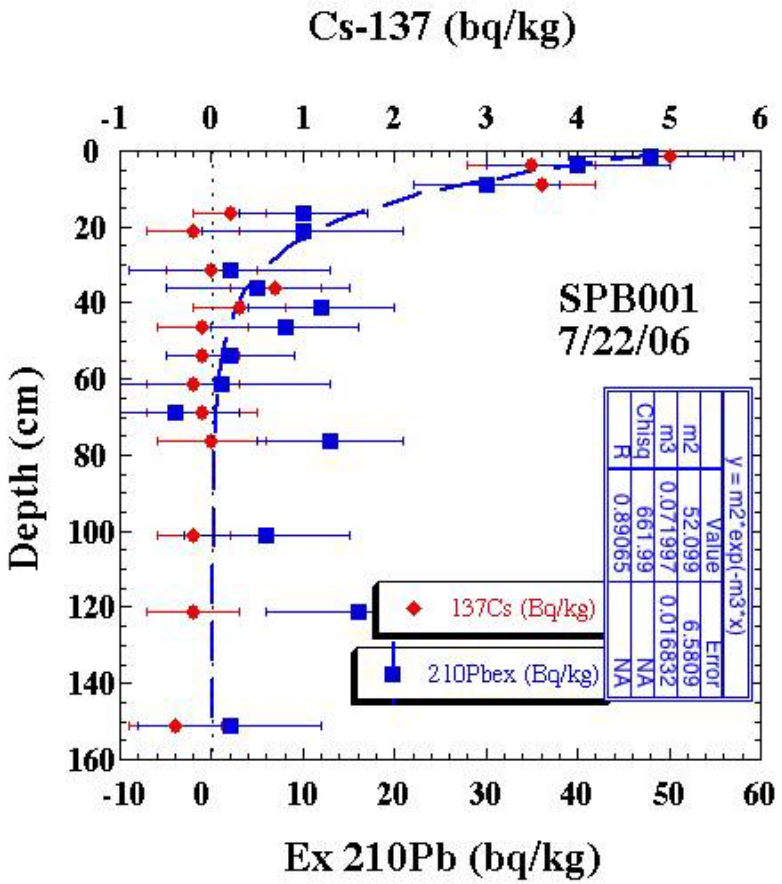
- Bay downcore concentrations smaller range than in SB/LSB

- No dating for wetland cores yet
  - ~20cm surbsurface max for Hg, Se, Cu in wetland,
  - Similarly high conc for Se, Cu @ surface, 60cm

SPB001: Erosion to ~1920s

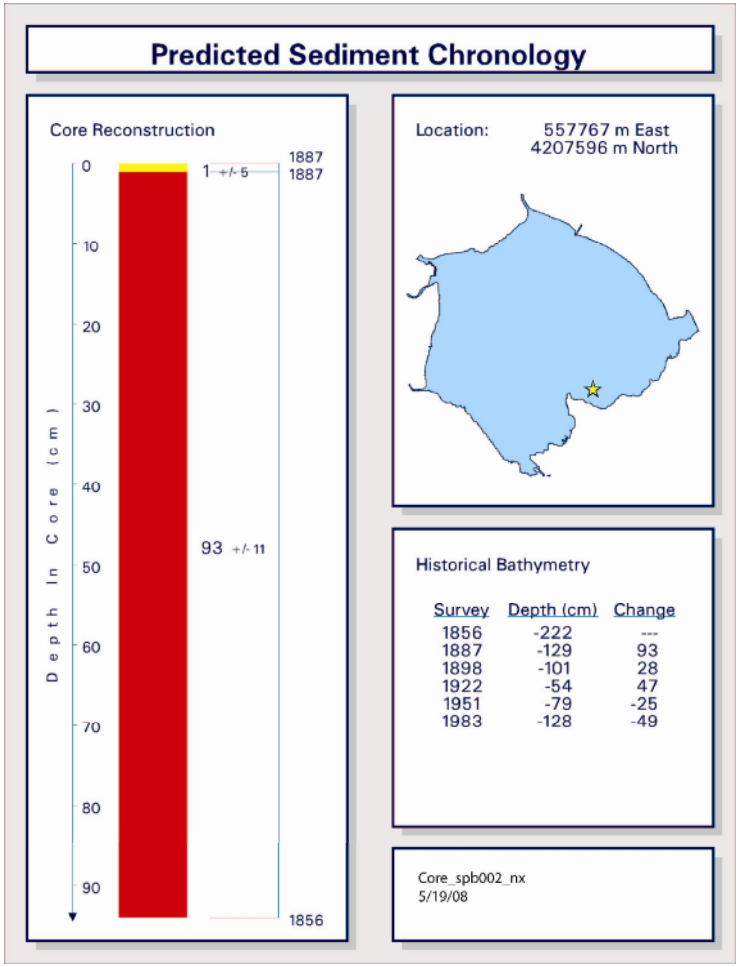


~0cm to 1960

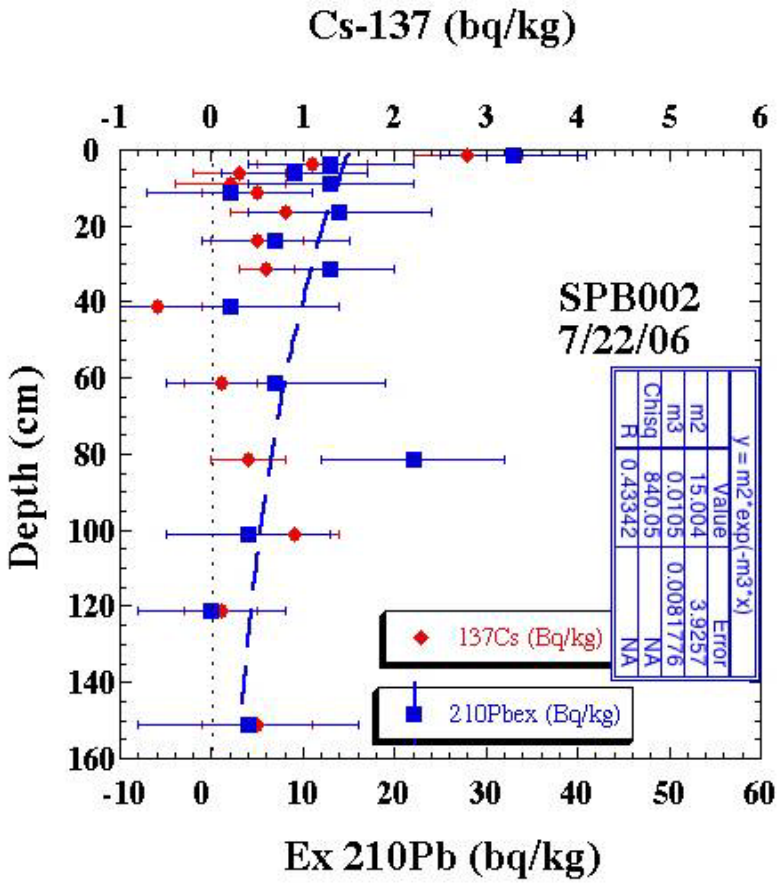


~5cm to 1960

SPB002: Erosion to ~1880s



~0cm to 1960

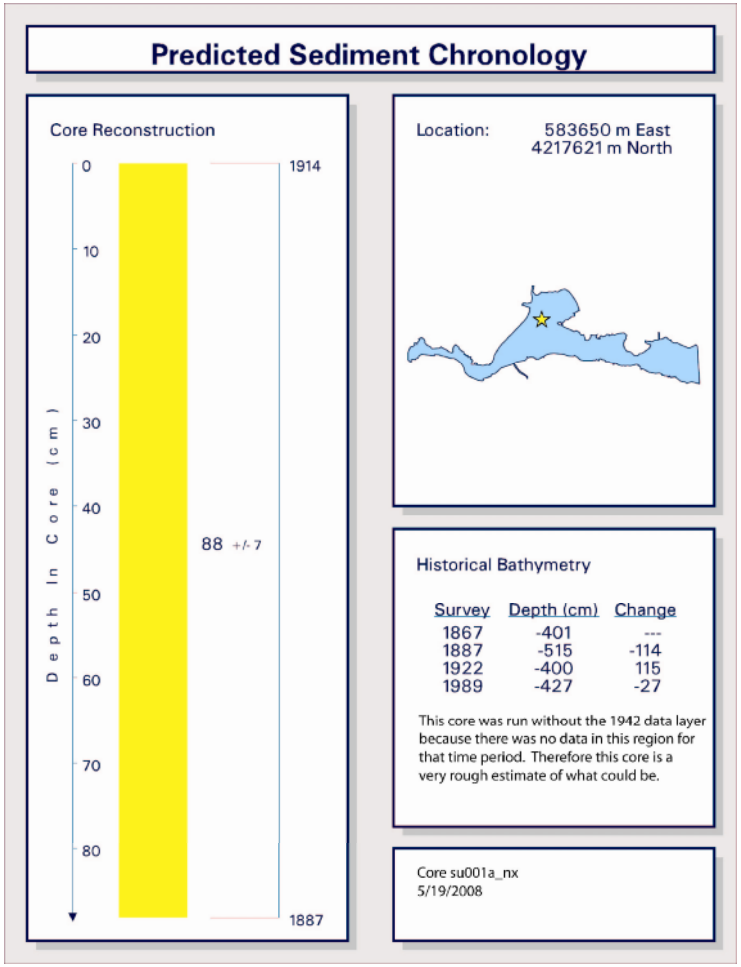


~2cm to 1960

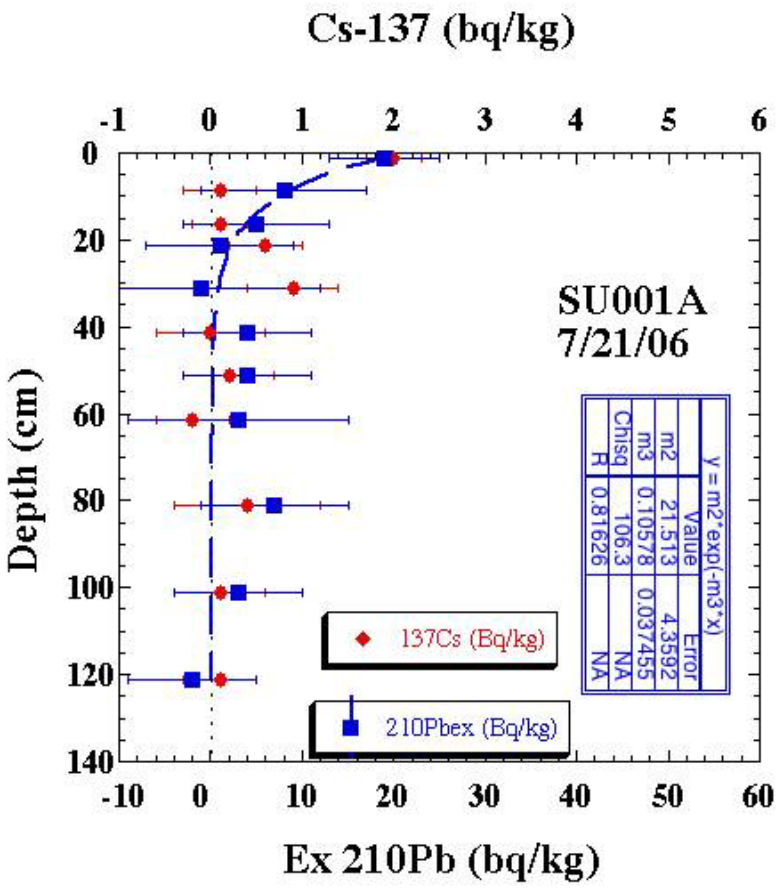
San Pablo Metals

- ~20cm surbsurface max for Hg, Se, Cu in wetland
  - No dating for wetland cores yet
  - No secondary metal peaks
  - Deeper concentrations fairly constant

SU001: Erosion to ~1910s

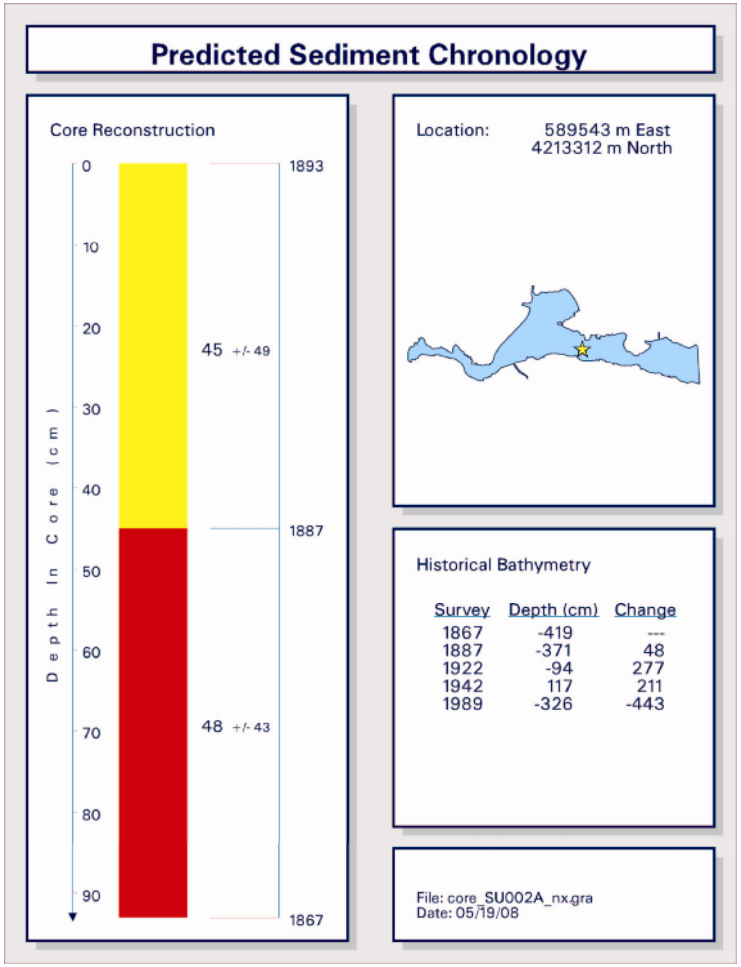


~0cm to 1960

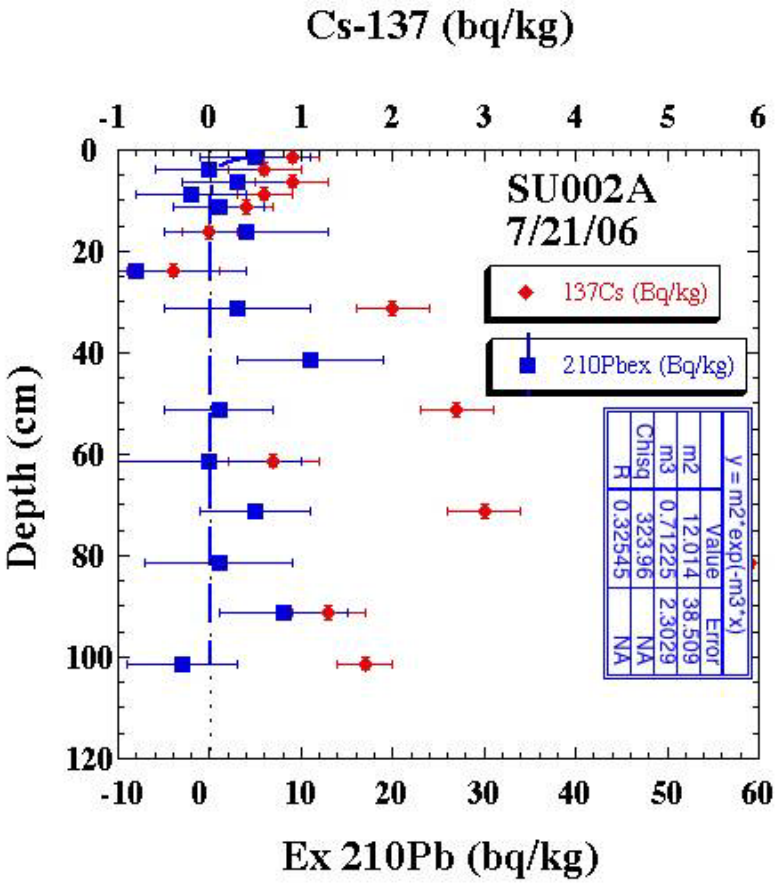


~2cm to 1960

SU002: Erosion to ~1890s



~0cm to 1960



~80cm to 1960?!!

Suisun Metals

- Hg highly variable @ Pt Edith and SU002
  - No dating for wetland cores yet
- SU002 max concentrations in top section
  - Hg, Se, Cu, subsurface spikes as well