Metals Mobilization in Bay-Delta Sediment Reuse

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Metals in Sediments

- Most metals in aquatic sediments generally bound in solids
  - Cationic forms (Hg2+, Cu2+, etc)
  - Complexed by organic carbon
  - Bound as metal sulfides
- Stable as long as binding materials not altered

Sediments tell our history

SF Bay core to scale >

Unless disturbed, much of it stays in place

Stability of Metals

- Bound metals are stable
  - If reduction oxidation states not altered
    - Oxidation of organic matter
    - Oxidation of sulfides
- Stability of in place sediments helped by
  - Low diffusion rates in liquids in solids

Challenges of Sediment Reuse

- Sediments moved from largely anoxic environments to aerobic (surface) environments
  - Release of OC and sulfide bound metals
- Other redox transformations (mercury methylation)
  - Hg^{2+} -> $CH_3\text{-}Hg^{+}$
  - Changing from oxic back to anoxic

Metals Management Strategies

- Can keeping sediments underwater help?
  - Yes, sometimes
  - Sediment surface will still get oxidized
  - Subsurface will see much less oxidation
    - Diffusion rates in air >> water

Metals Management Strategies

- Sometimes anoxia hurts
  - Sacramento channel dredging placement ponds
    - Methylmercury concentrations rose and remained high 4 weeks + until site dried out
    - Methylmercury production highest in site with excess vegetation fueling methylation
    - Impact to river minimized by preventing water release during period of high methylmercury

Metals Management

- Containment
  - Montezuma Project constructed low conductivity levees around contaminated sediments placed
    - Below mean low tide, minimize risk of channel incision
  - Monitoring wells around contaminated sediments

Take Home

- Moving sediments from anoxic to oxic environments will lead to some mobilization
- Manageable through containment during activities
  - Keeping conditions stable minimize further mobilization
  - Physical containment can prevent wider transport