

Description of Stratigraphy Study with supporting information

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Management Questions

Directly addresses:

1) Is sand mining at existing lease areas, at permitted levels, having a measurable or demonstrable impact on sediment transport and supply within San Francisco Bay or the Outer Coast?

1.b) What is the source of mined sand in the lease areas? Is it “relic” sand, or “new” sand transported into the system?

Contributes to addressing:

1.e) Does mining in both areas (Central Bay and Suisun Bay) have the same effects on sand transport pathways and associated impacts? Should these areas be examined separately?

2) What are the anticipated physical effects of sand mining at permitted levels on sand transport and supply within San Francisco Bay and the Outer Coast?

2.a) Is there regional uplift/subsidence or other factors that would confound evaluation of sand mining effects?

Fingerprinting sand and its transport history through San Francisco Bay:
Implications for sand mining and its environmental effects

aka the Stratigraphy Study

To be performed by:

Stanford Univ.

Univ. of Texas at Austin

U.S. Geological Survey

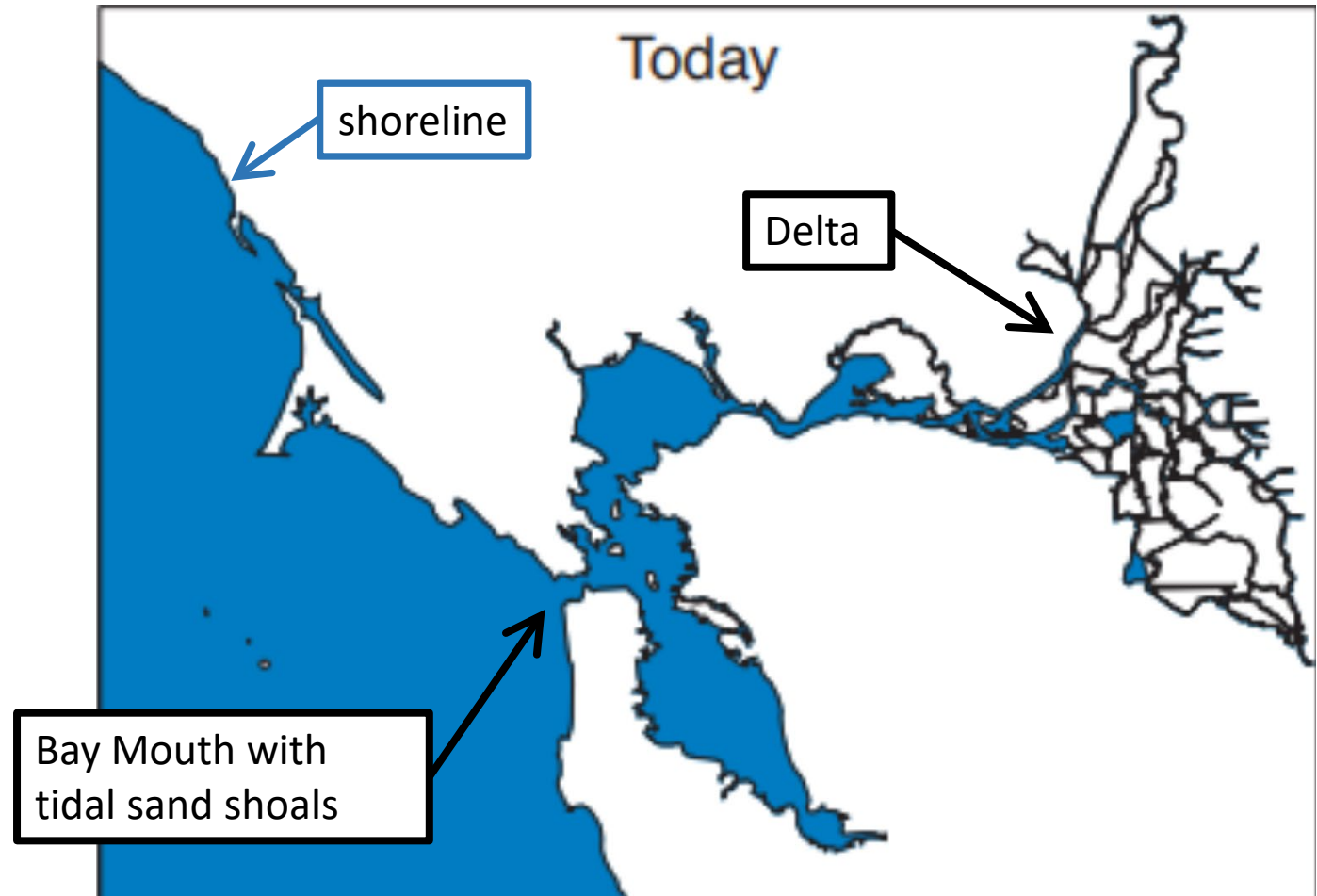
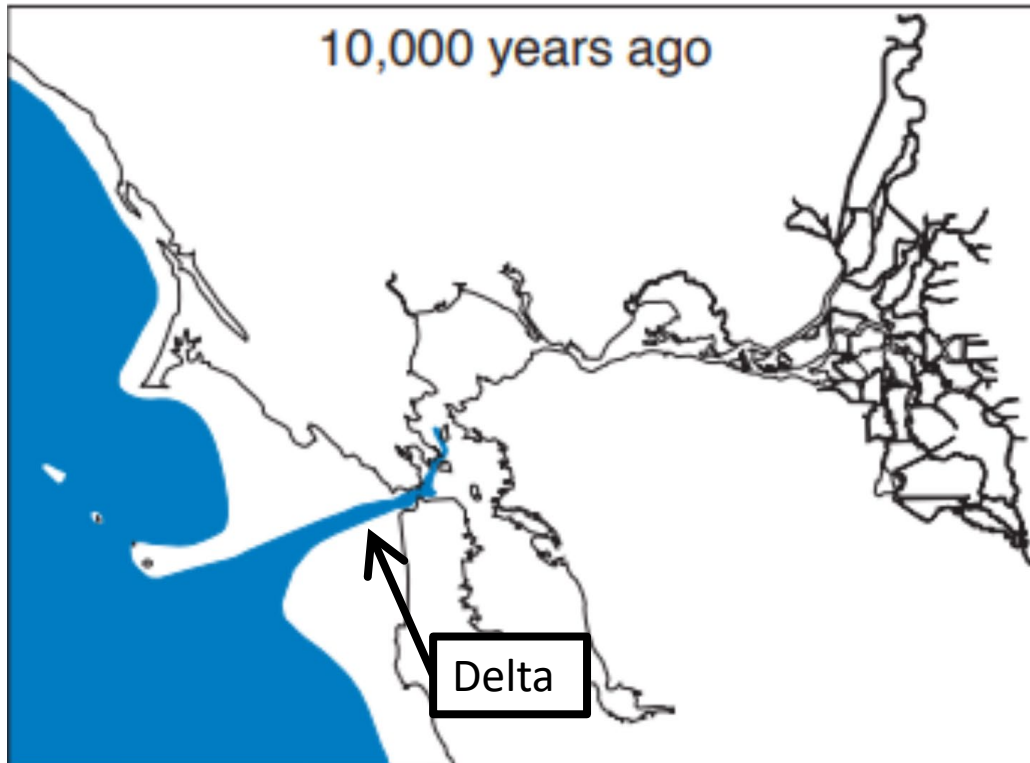
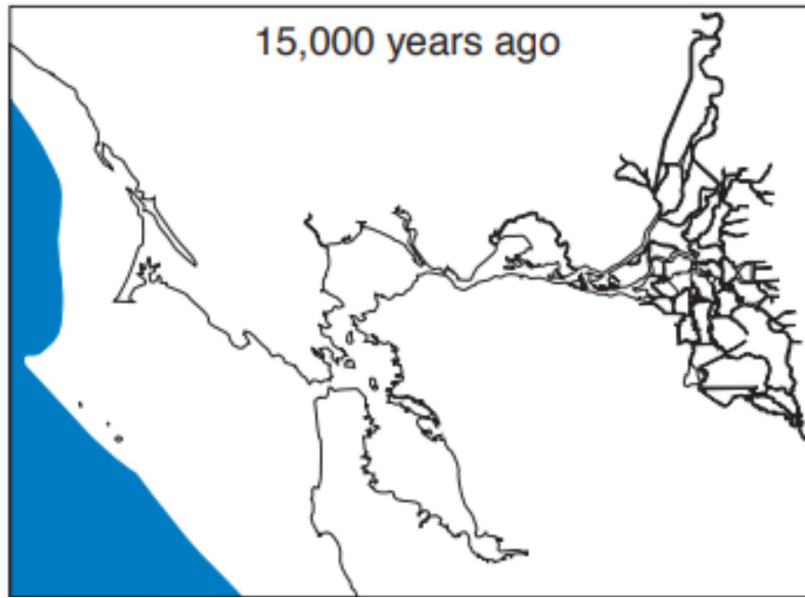


Background

- “Stratigraphy” - layers of sediment
- Most sand probably deposited thousands of years ago when sea levels lower
- Upper layers – actively moving, reshaped, old and new sand
- Lower layers – sequestered, old sand (aka “relict” or “relic”)

Sea-level rise of ~ 400 feet changed river valley to bay with tidal inlet and inland river delta

Modified from Source: Cohen, A., 2000. An Introduction to the San Francisco Estuary, 3rd edition.
<https://sfestuary.org/wp-content/uploads/2012/12/Intro-to-SF-Estuary-PDF.pdf>



Stratigraphy Study Summary

- Review available sediment samples (about 300 available – prior research)
- Analyze selected sediment samples to determine source and age
- Interpret sediment transport patterns
- 1.5 year study
- \$116,000
- No new fieldwork (too expensive) but wish we could get core(s) in central bay

Stratigraphy Study Area

Surface sediment size classes

- coarse sand - orange
- medium sand – brown
- fine sand - tan
- mud – grey
- blue – not mapped

Sediment samples – circles and triangles

Sand mining areas – green/black

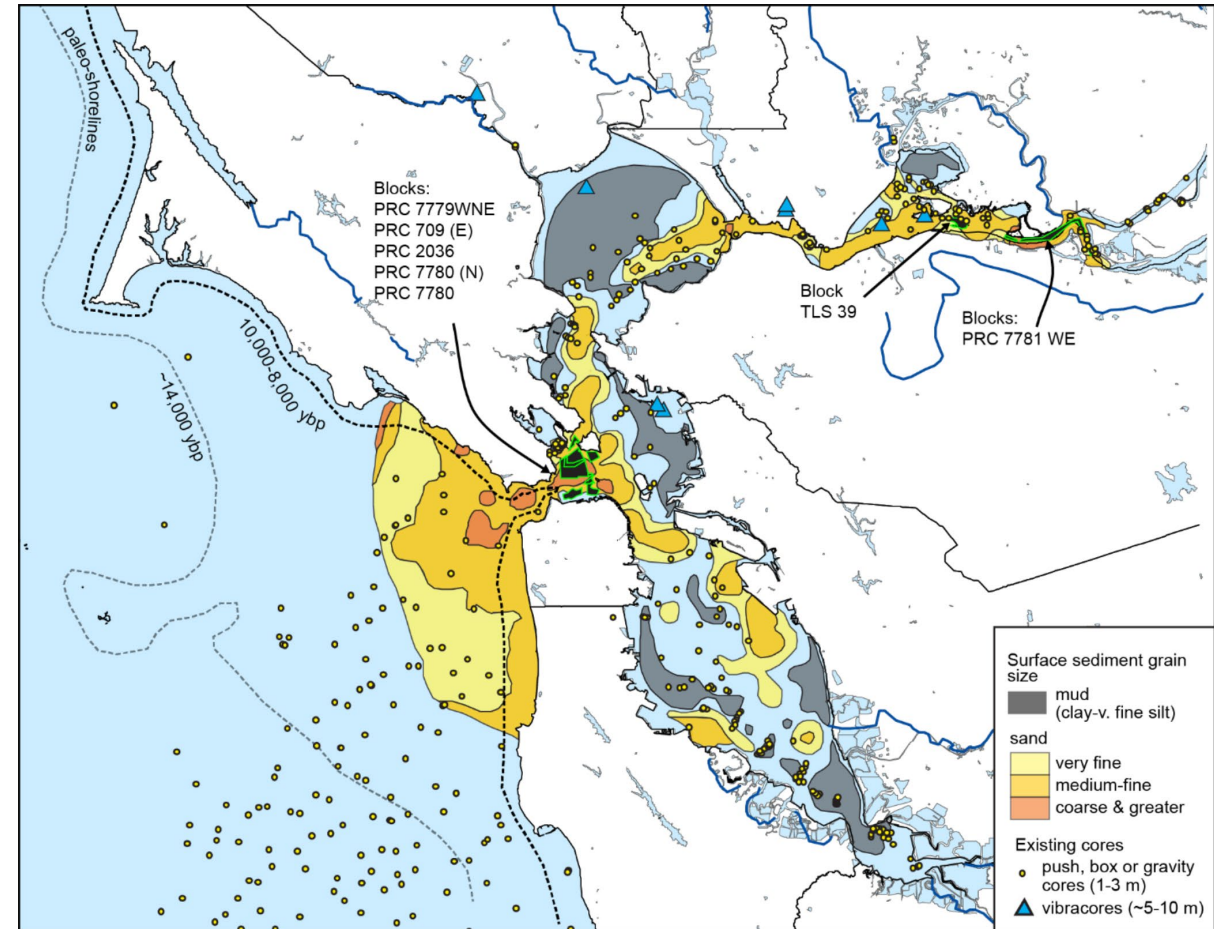

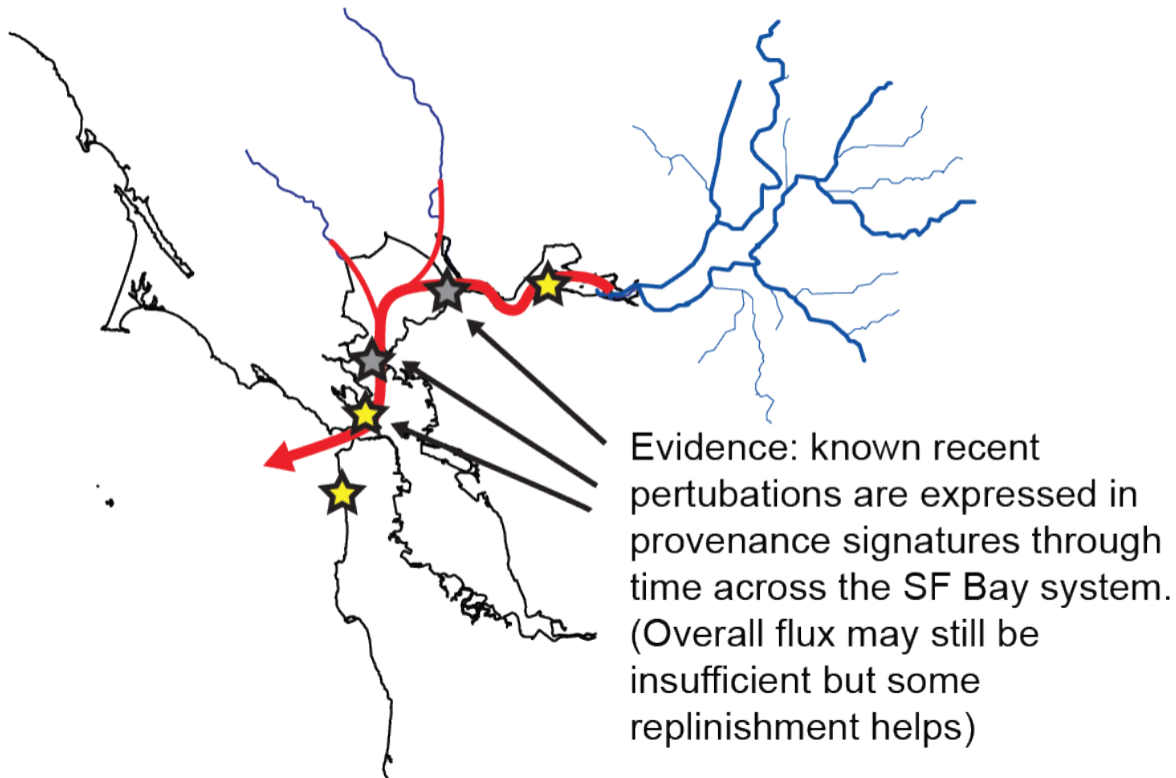



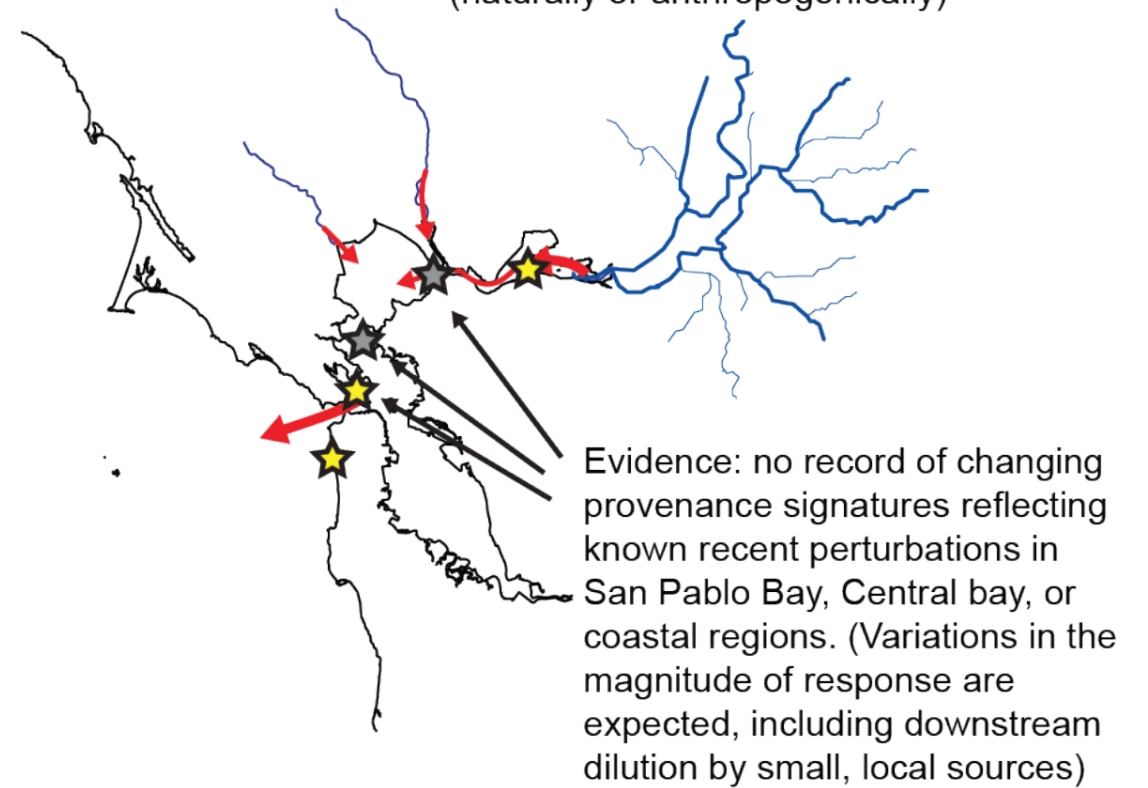
Figure 1. Overview map of the San Francisco Bay Area highlighting grain size distribution, sand mining lease blocks, and the locations of select cores collected since 1990. Dashed lines along coast delineate approximate extent of paleo-shorelines.

Alternative Conceptual Model “bookends”

 Hypothesis 1: sustainable “new” sediment



 Hypothesis 2: unsustainable, “relic” sediment, no “new” sediment (naturally or anthropogenically)



Extras
follow



Historical Perspective

Most sand deposited 3,000 to 10,000 years ago as rising sea levels formed the bay and shifted the rivers inland

Source: Figure 2 from Stanford-UT-USGS Proposal, 2021; Derived from Atwater, B.F., C.W. Hedel, E.J. Helley, B.F. Atwater, C.W. Hedel, E.J. Helley, 1977, Late Quaternary depositional history, Holocene sea-level changes, and vertical crust movement, Southern San Francisco Bay, California, U.S. Geological Survey Professional Paper 1014

