Back to the Future: The History of San Francisco Bay
Organized by Doris Sloan & Jere H. Lipps
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• Marine Biology
• Paleontology
• Geology

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Past Climate & Sea Level

- Based on $O_2$ isotope changes ($^{18}O$ & $^{16}O$) through time related to:
  - Temperature of the water.
  - Amount of ice on land.
  - Ice volume is related to sea level.
Climate/Sea Level Curve for the Past 500,000 Years

p.s.l.
Past 150ka
Sea Level Curve Last 135ka

Marine Oxygen Isotope Stages

Years before present (x 1000)
Regression: Lowering of sea level cuts V-shaped valleys.

Transgression: Rising sea level fills V-shaped valleys.
San Francisco 18,000 years ago

Sea Level
-100 m
Sea level rise in S. San Francisco Bay

Meters below p.s.l.

X 1000 years ago
San Francisco Bay Today

- Highest sea level stand in 125 ka.
- Deepest sedimentary fill in 125 ka.
- Most extensive marshes in 125 ka.
- But only ~10% left.
- Organisms evolved without much marsh.
San Francisco: Sea Level Rise
Greenhouse Overshoot

[Diagram showing the change of global mean temperature over time, with projected future impacts and observed past changes.]
# Potential Sea Level Rise

<table>
<thead>
<tr>
<th>Region</th>
<th>Volume (km$^3$)</th>
<th>Rise (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Antarctica</td>
<td>26,039,200</td>
<td>64.80</td>
</tr>
<tr>
<td>West Antarctica</td>
<td>3,262,000</td>
<td>8.06</td>
</tr>
<tr>
<td>Antarctic Peninsula</td>
<td>227,100</td>
<td>0.46</td>
</tr>
<tr>
<td>Greenland</td>
<td>2,620,000</td>
<td>6.55</td>
</tr>
<tr>
<td>All other ice</td>
<td>180,000</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>32,328,000</strong></td>
<td><strong>80.32</strong></td>
</tr>
</tbody>
</table>
What Really Matters

• *Values?* No, because there is little scientific basis for values.

• *History?* Yes, because it shows system processes.

• *Change?* Yes, because it happens continuously but not usually perceptibly in human terms.
Change is the Constant Condition, Not Stability!
What about San Francisco Bay?

**I. Sea level rises**
- Salinity rises
- Floods low-lying areas
- Marshes flood & die
- Dike major structures
- Dam the Golden Gate

**II. Sea level falls**
- Salinity decreases
- Shores & sediments erode
- Shipping restricted
- Invading organisms killed
- Dam the Golden Gate