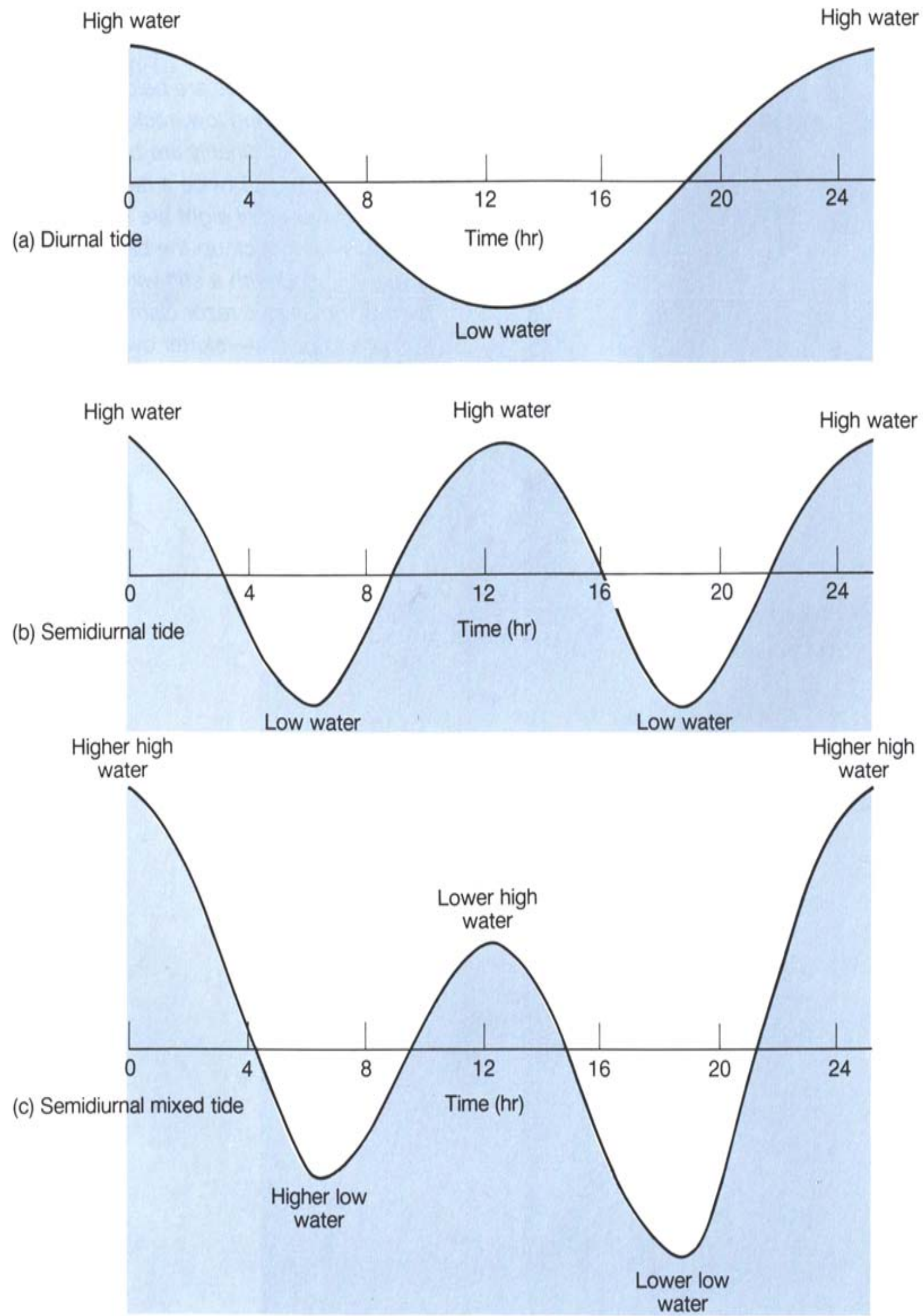
Daily tidal fluctuations

(actually a little more than 24 hours)

Most areas have semidiurnal fluctuations, with two nearly equal high and low tides each day

Some areas have diurnal fluctuations, with one high and one low each day

Other areas have mixed semidiurnal fluctuations, with two highs and two lows of unequal elevation

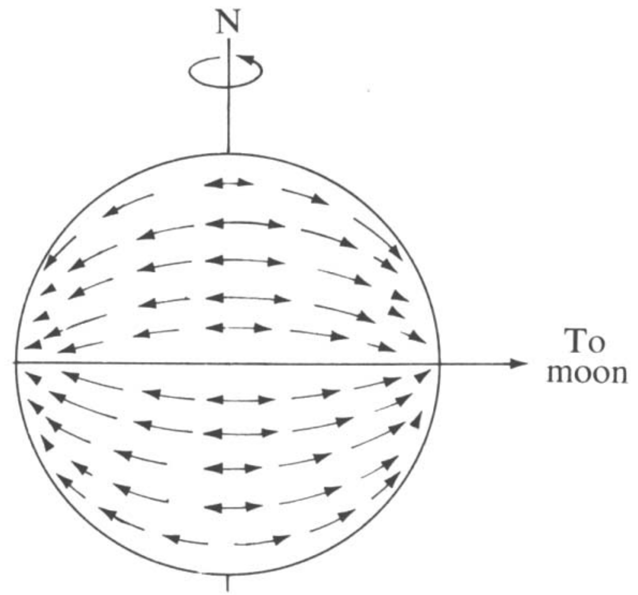


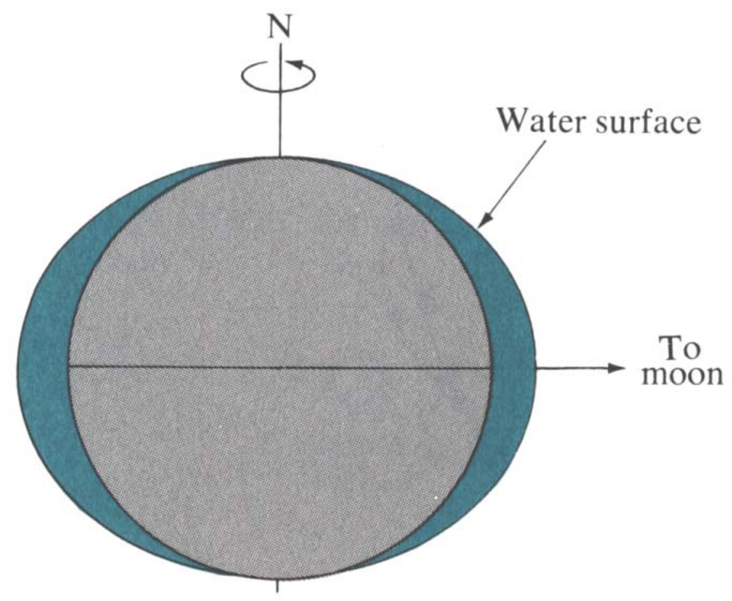
Cause of Tides

Gravitational attraction of moon/sun creates bulge of ocean water

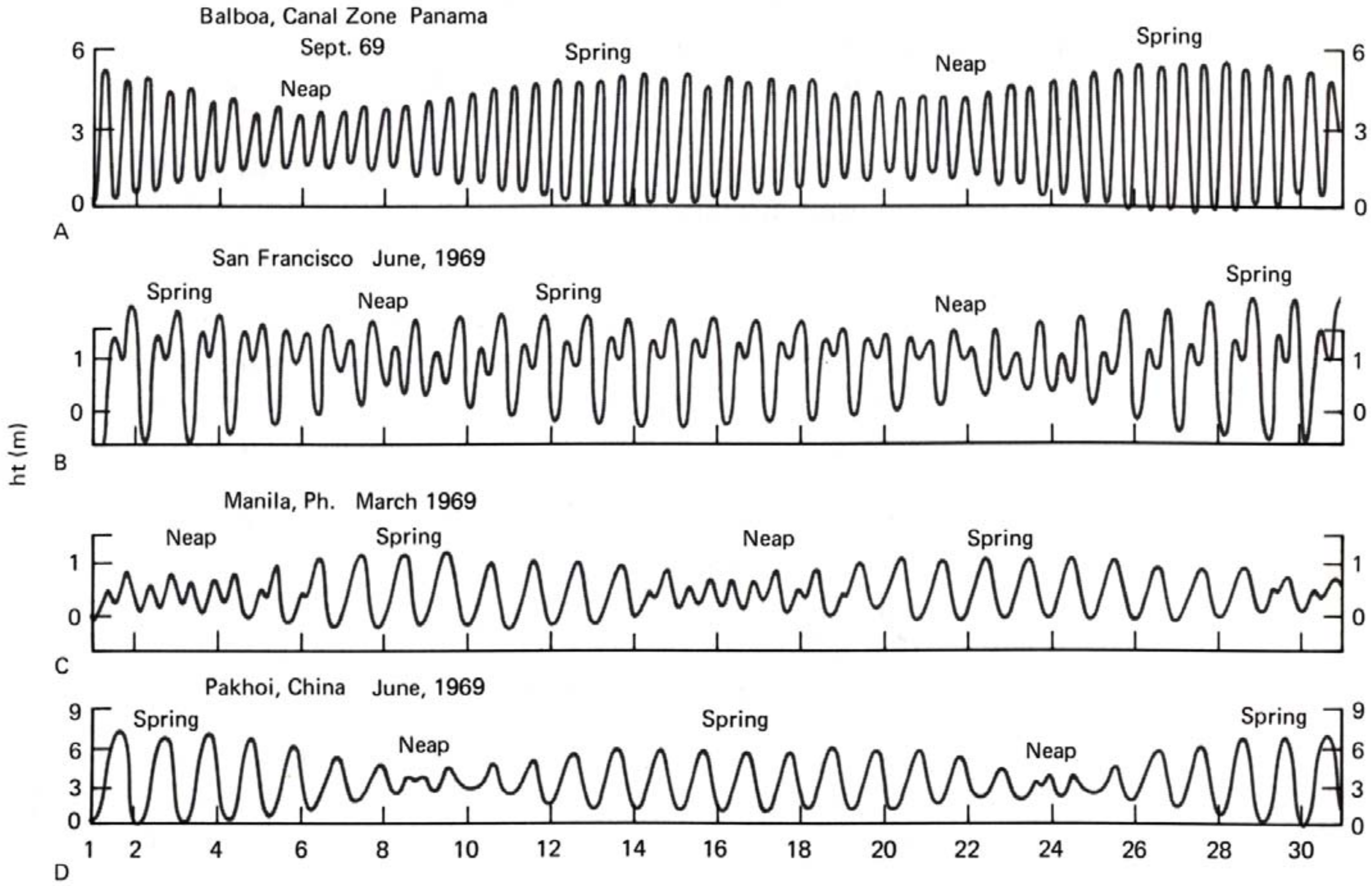
Centrifugal force creates second bulge

Earth rotates through both bulges in ~24 hours, causing two high and two low tides each day





Monthly fluctuations in tides



Over ~28 days, orientation of moon and sun changes with respect to Earth

This causes two periods of large tidal range (spring tides) and two periods of small tidal range (neap tides) each month

Why we have monthly changes in tides

Gravitational attraction from moon and sun pull water toward them

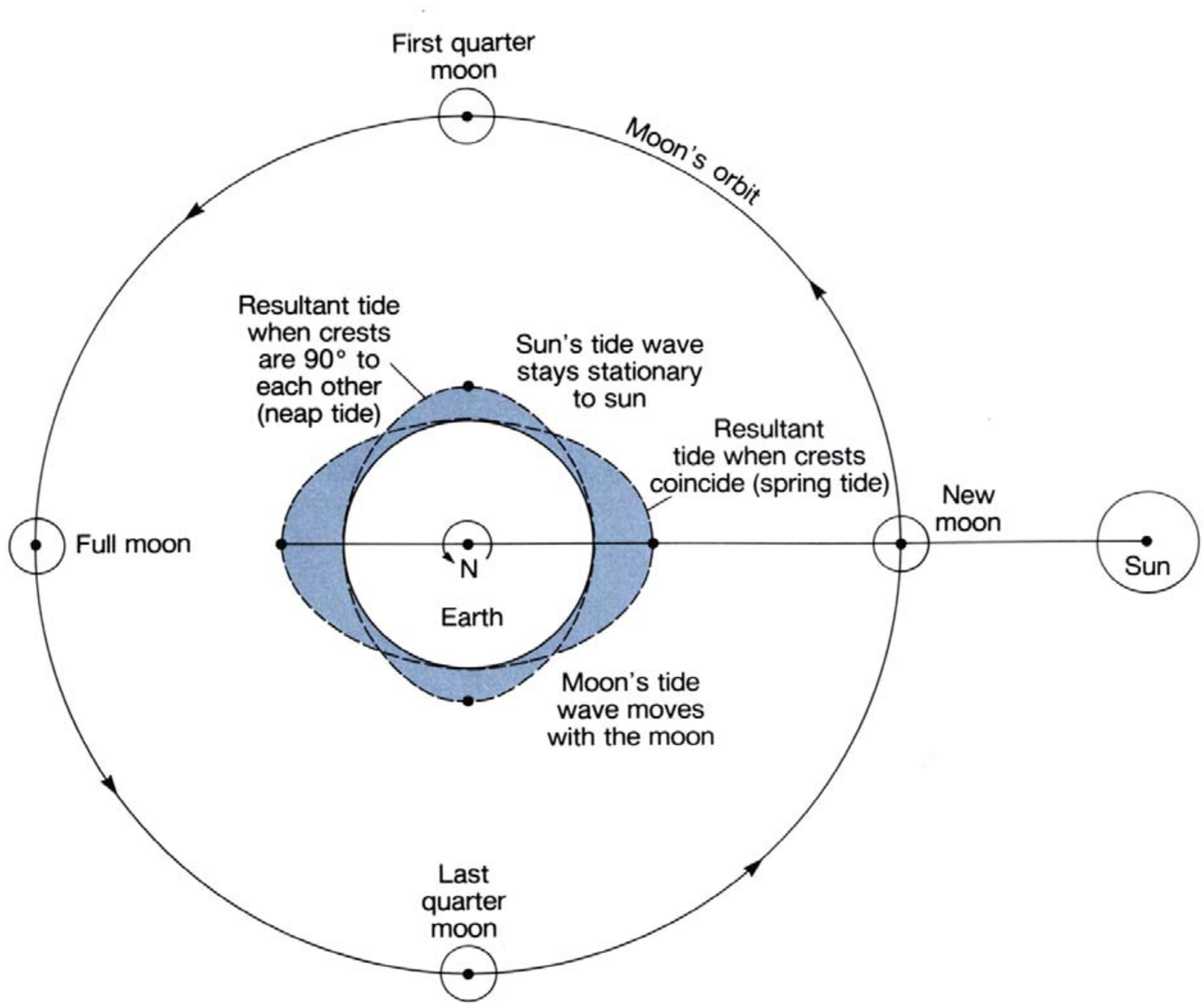
This creates two bulges

As the Earth rotates through these bulges each day, locations experience changing sea level

Over a ~28-day period, the orientation of the moon and sun change, creating different tidal ranges through month

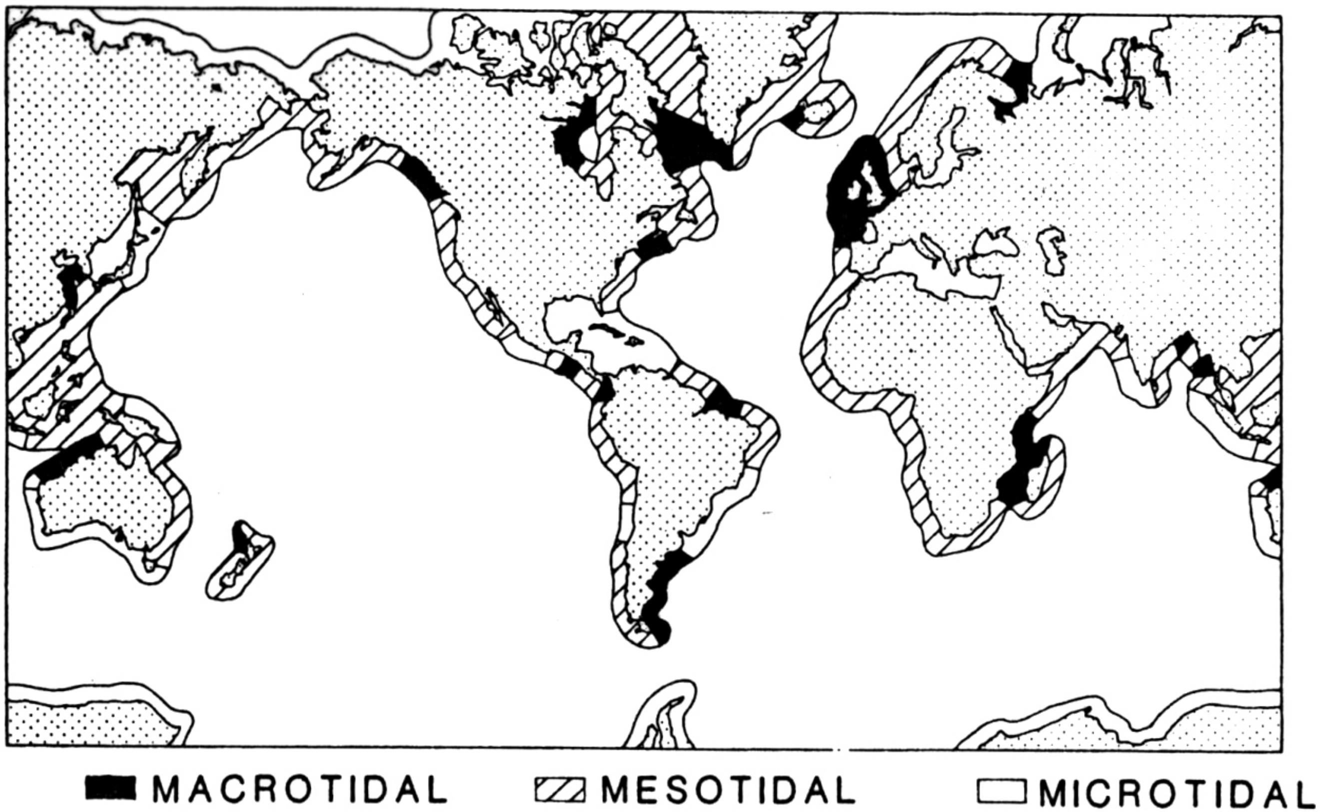
Spring tide = large differences

Neap tide = small differences



Tidal range

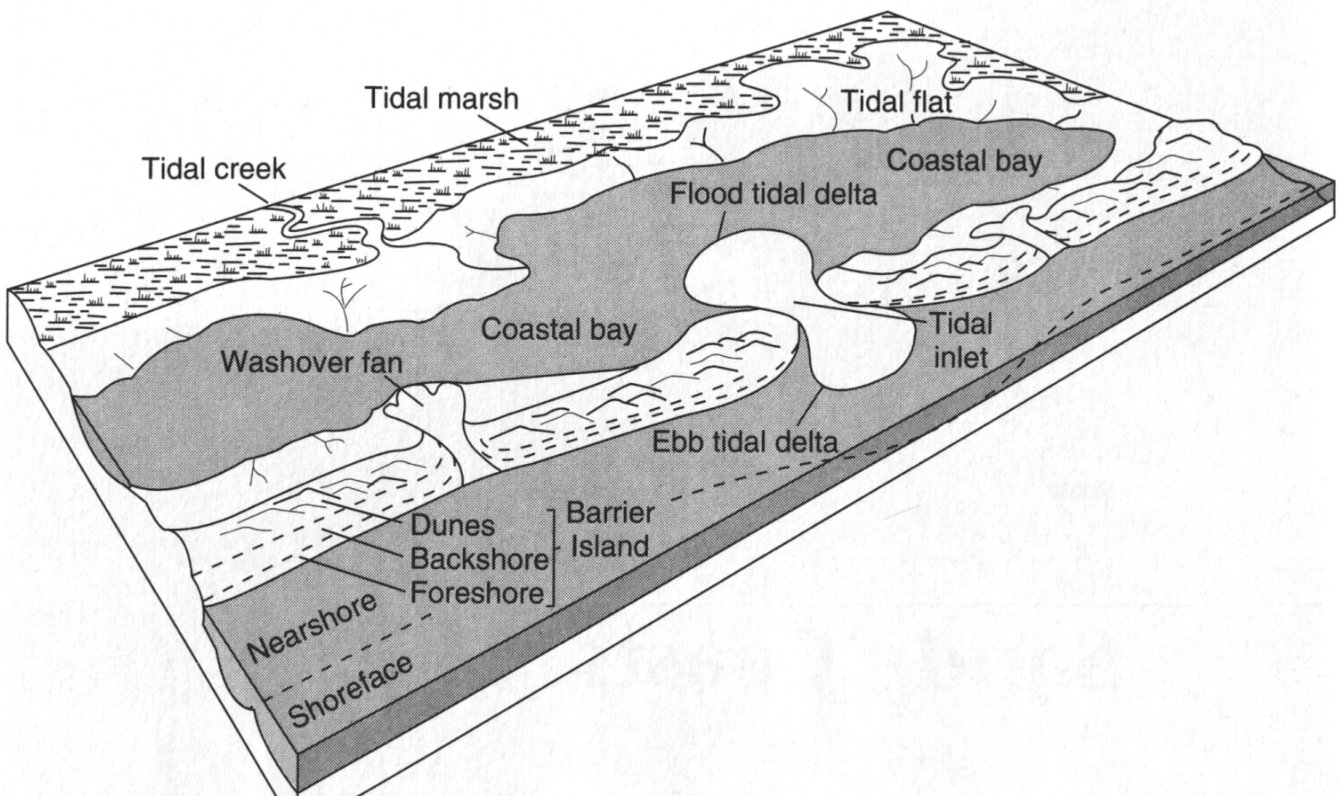
(vertical difference between high and low tide)



Macro > 4 m Meso = 2-4 m Micro <2 m

Local differences in geometry of seabed can increase or decrease tidal range

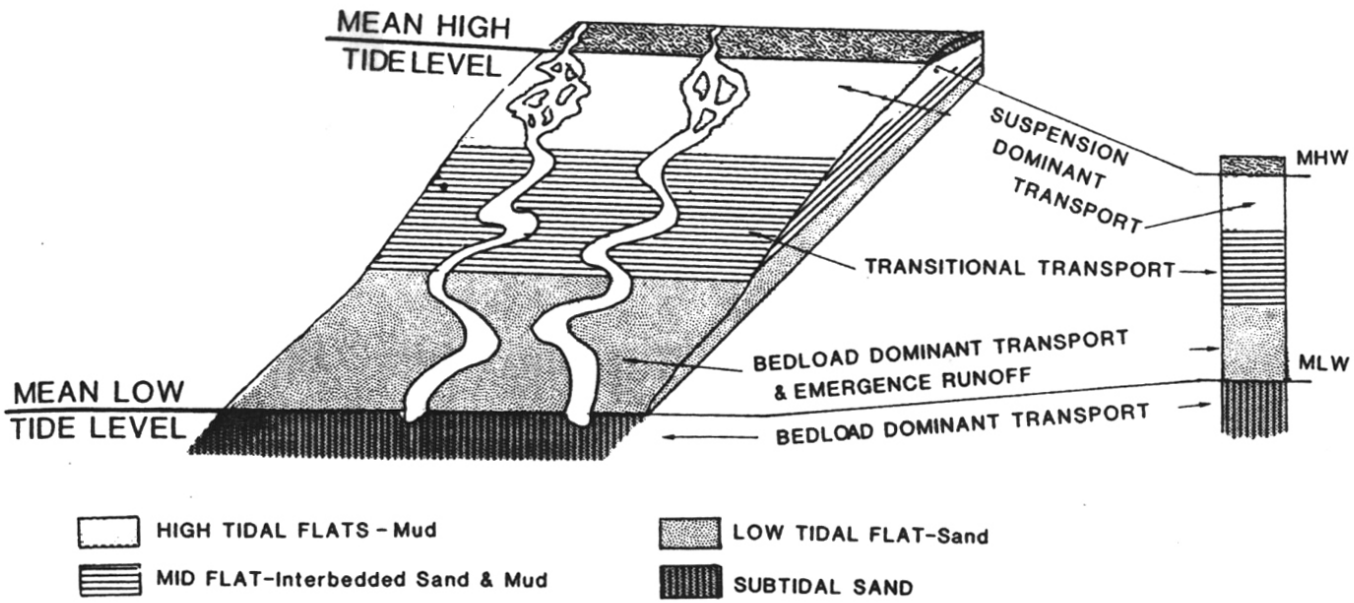
Lagoonal environments



Intertidal environments (between high and low tide) surround lagoon

They trap and accumulate sediment, filling lagoon

Tidal-flat sedimentation

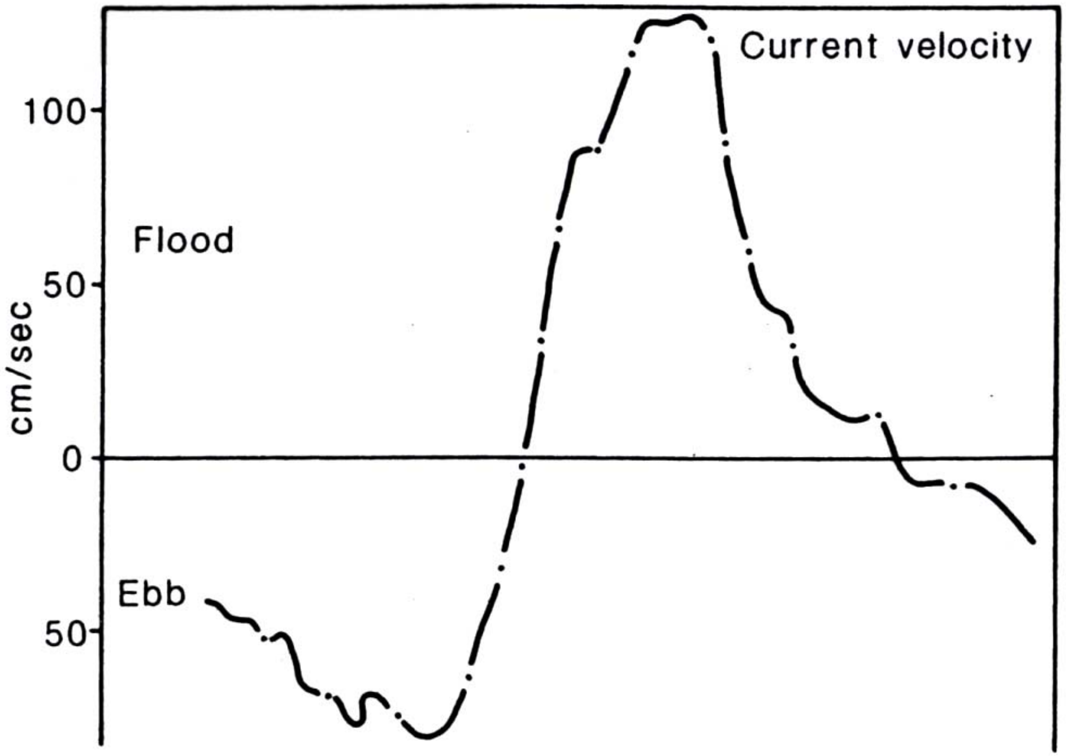


Mud transported as suspended load accumulates on high flat

Sand transported as bedload accumulates on low flat

Upward growth ultimately controlled by rate of sea-level rise

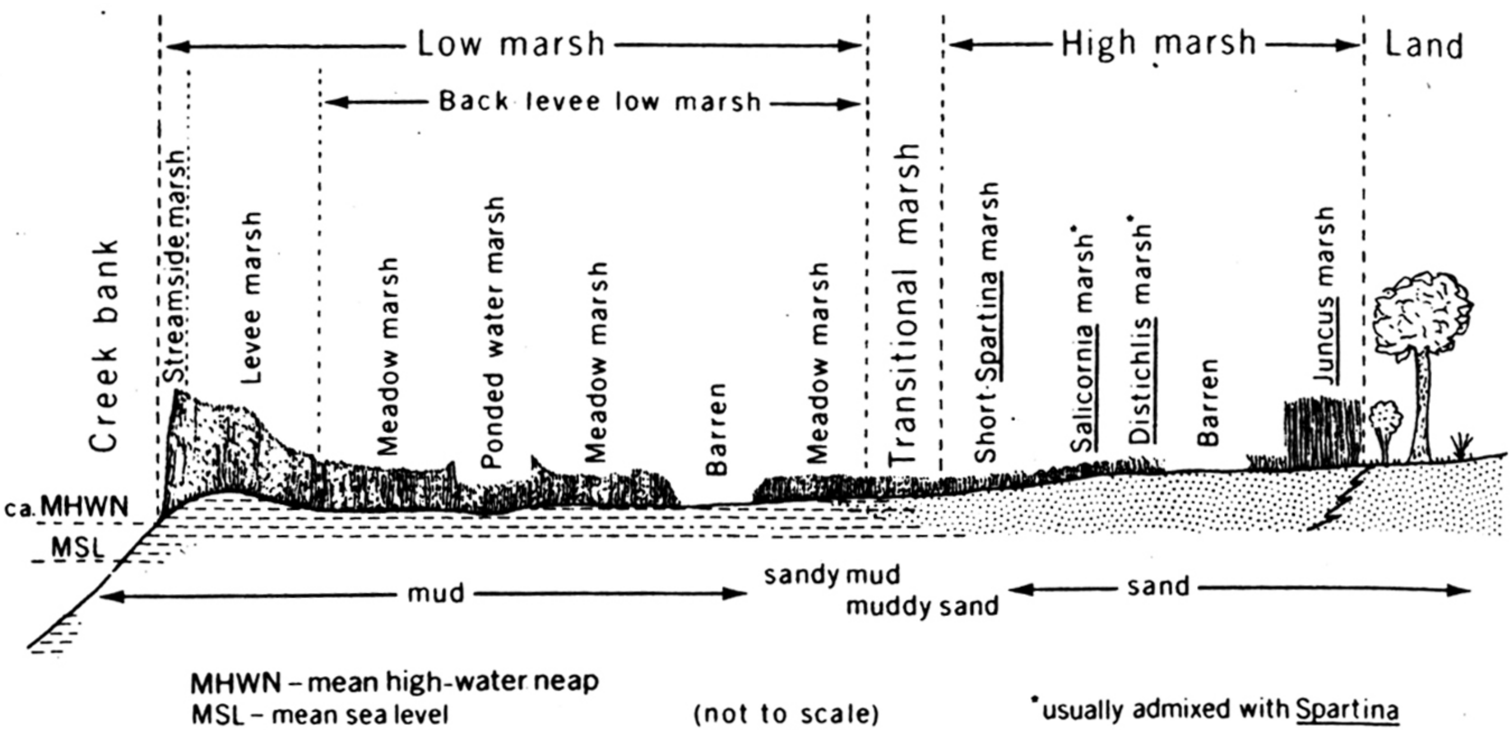
Asymmetry between flood and ebb currents



Frictional interaction with seabed commonly causes flood current to be stronger

This results in more sediment being transported into the lagoon and onto the tidal flats, enhancing accumulation

Marsh vegetation

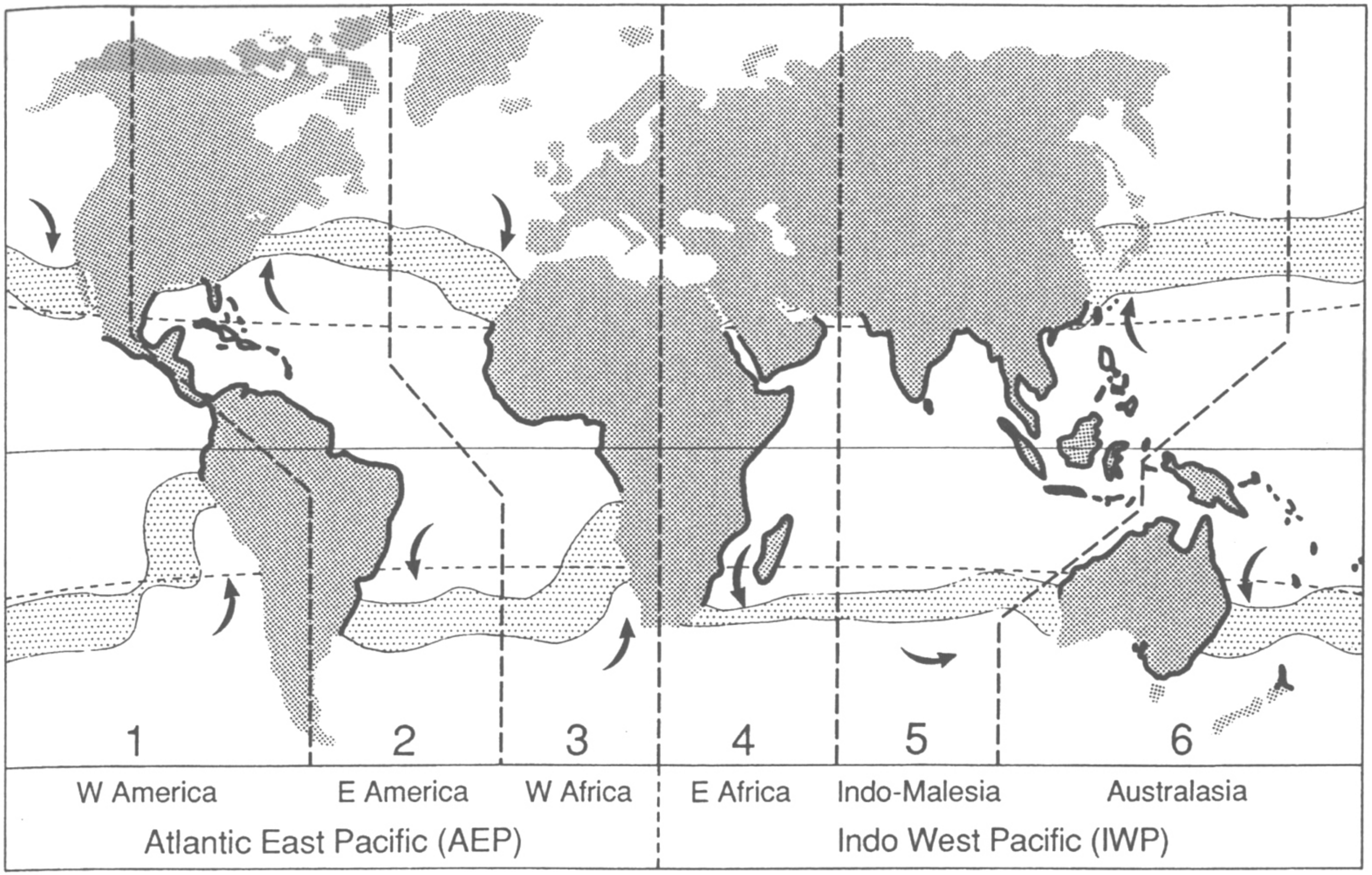


Many niches develop, depending on many variables, e.g.,: salt and soaking tolerance, and current velocity

Vegetation helps to baffle flow, reduce tidal current velocity, and enhance sediment accumulation

Mangrove vegetation

Mangrove distribution



Found in warm, tropical settings

Ocean circulation extends latitudinal distribution on west sides of ocean basins, and reduces distribution on east sides

Sediment Budget for Beaches and Coasts

Sediment Sources:

Longshore drift (local source)

Cliff erosion

Rivers

Biogenic shells

Continental shelf

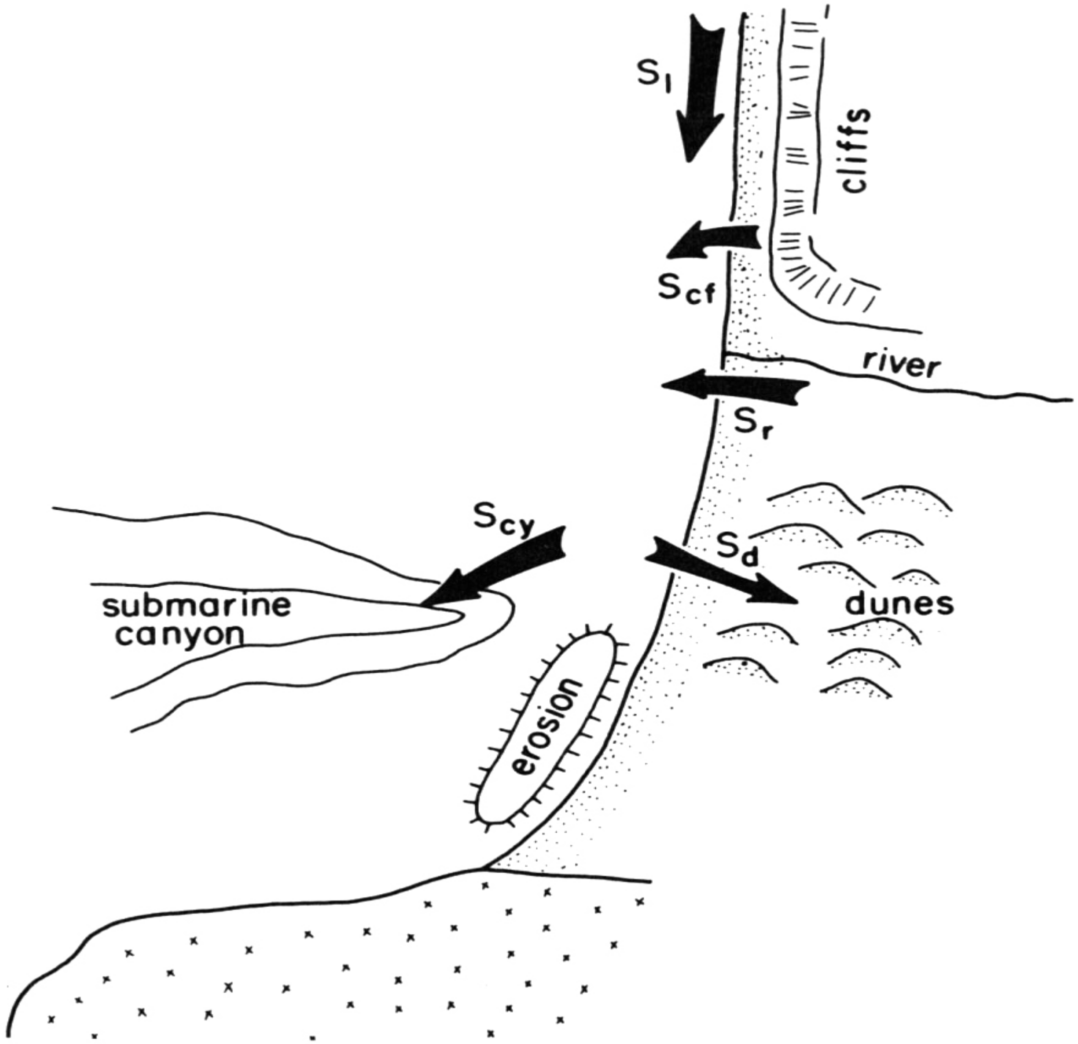
Sediment Losses:

Dunes

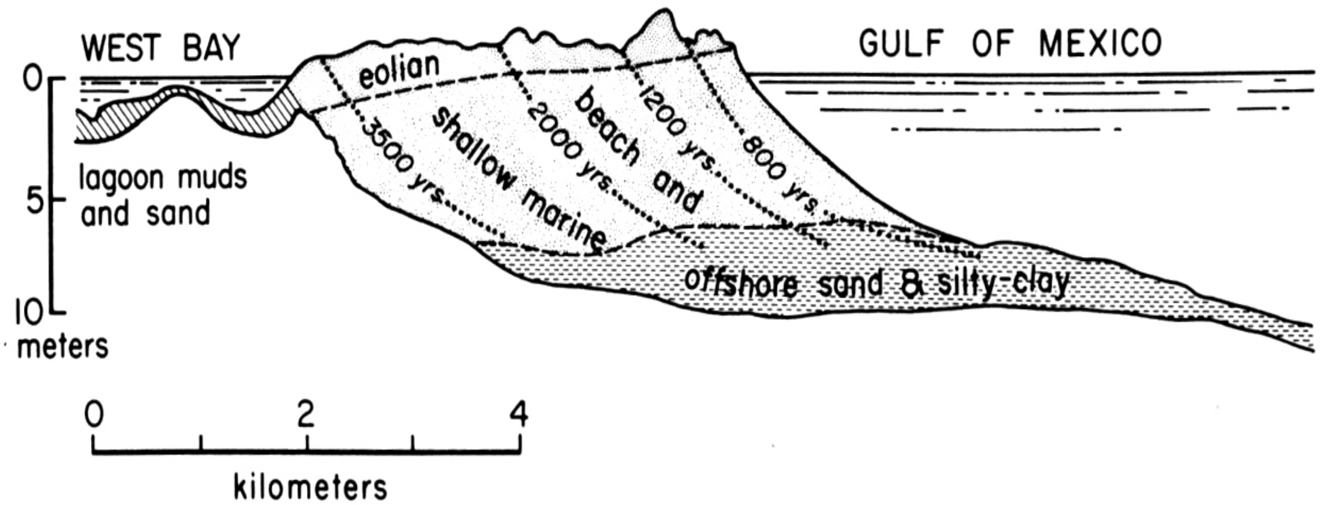
Lagoon (washover, tidal inlets)

Submarine canyons (unusual)

Longshore drift (local sink)



Prograding shoreline, building seaward

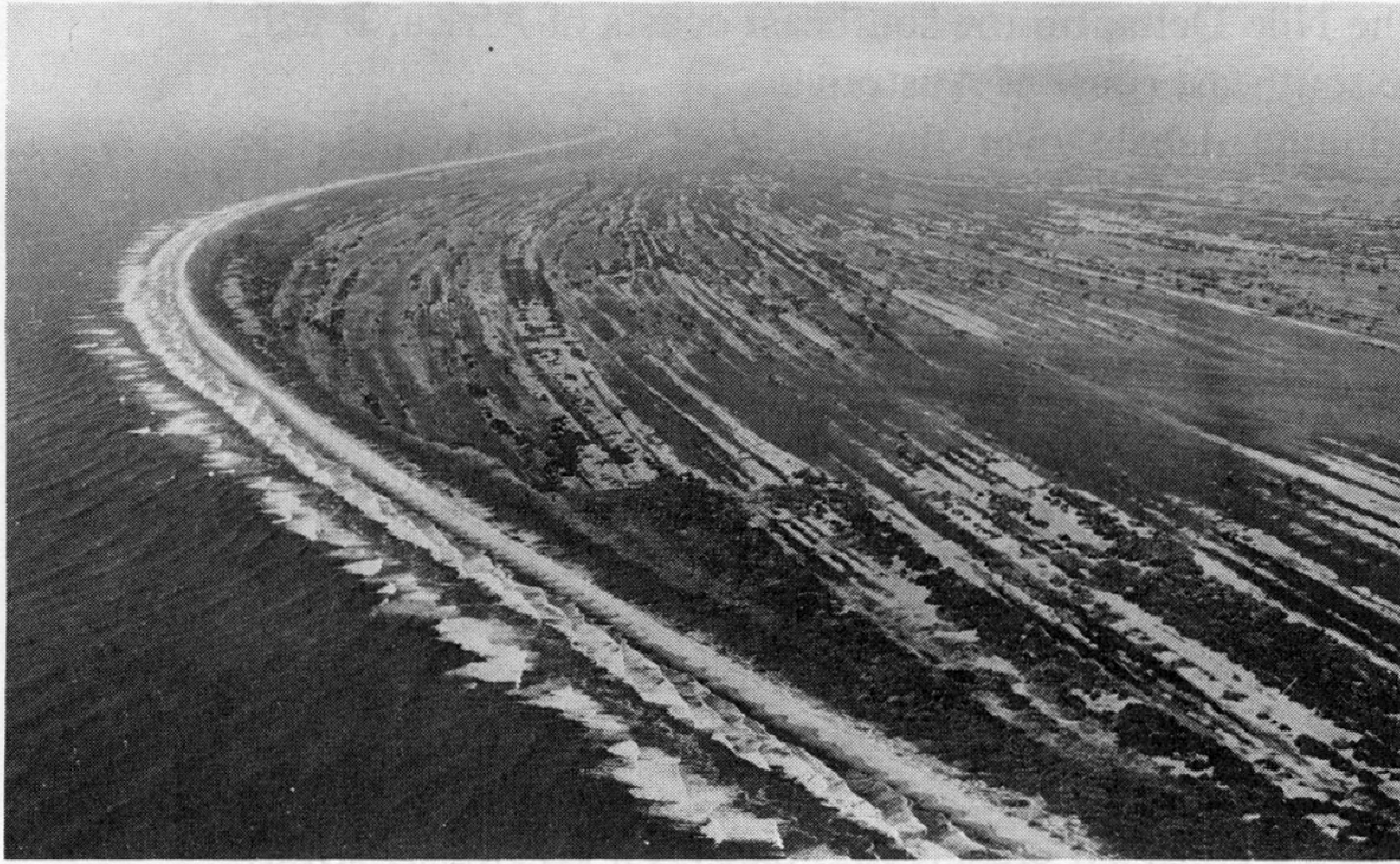


Requires sediment supply to exceed processes leading toward landward movement of shoreline.

Rivers are most common supply mechanism

(example from east Texas coastline, downstream of Mississippi supply)

Prograding beach ridges

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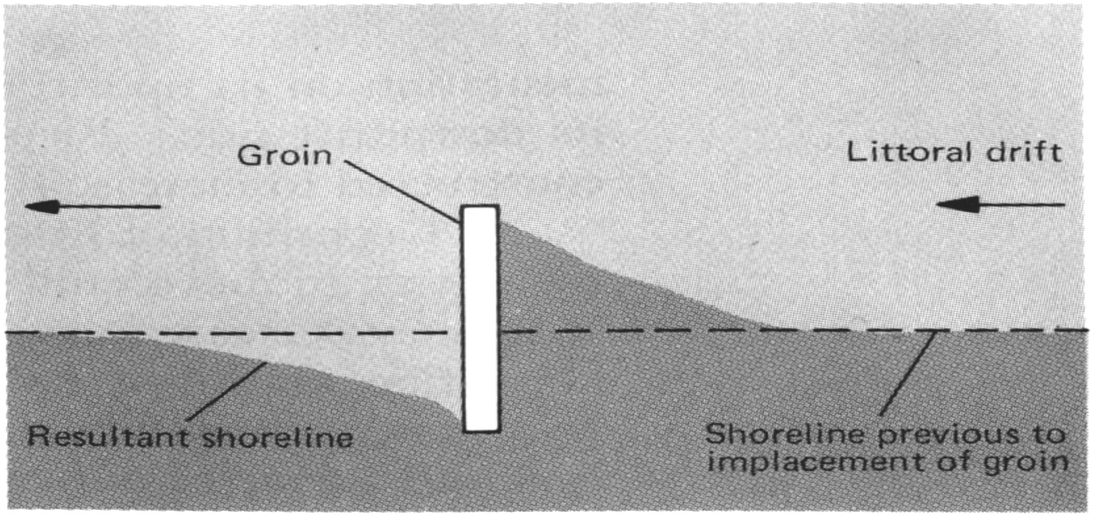
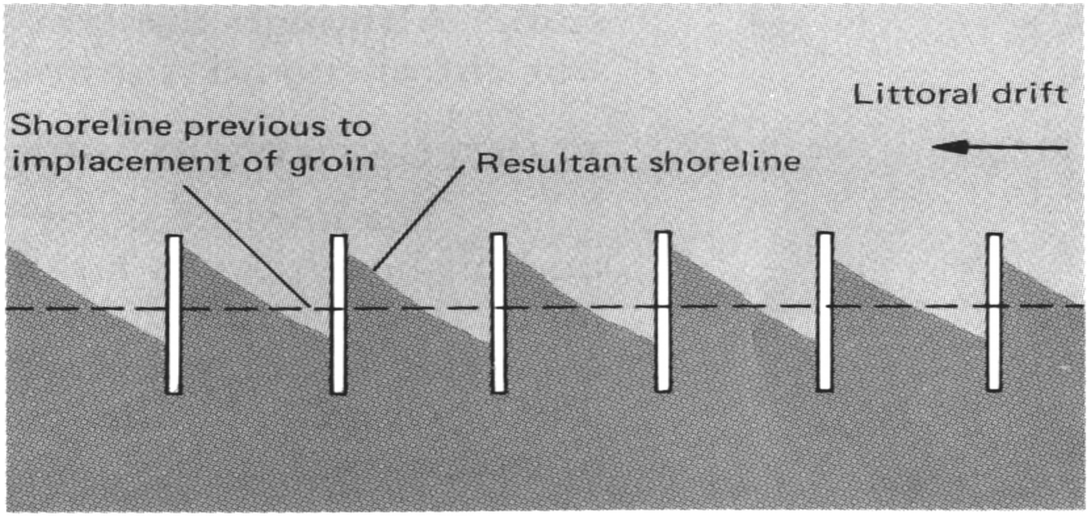
Impact of Groins to Shoreline

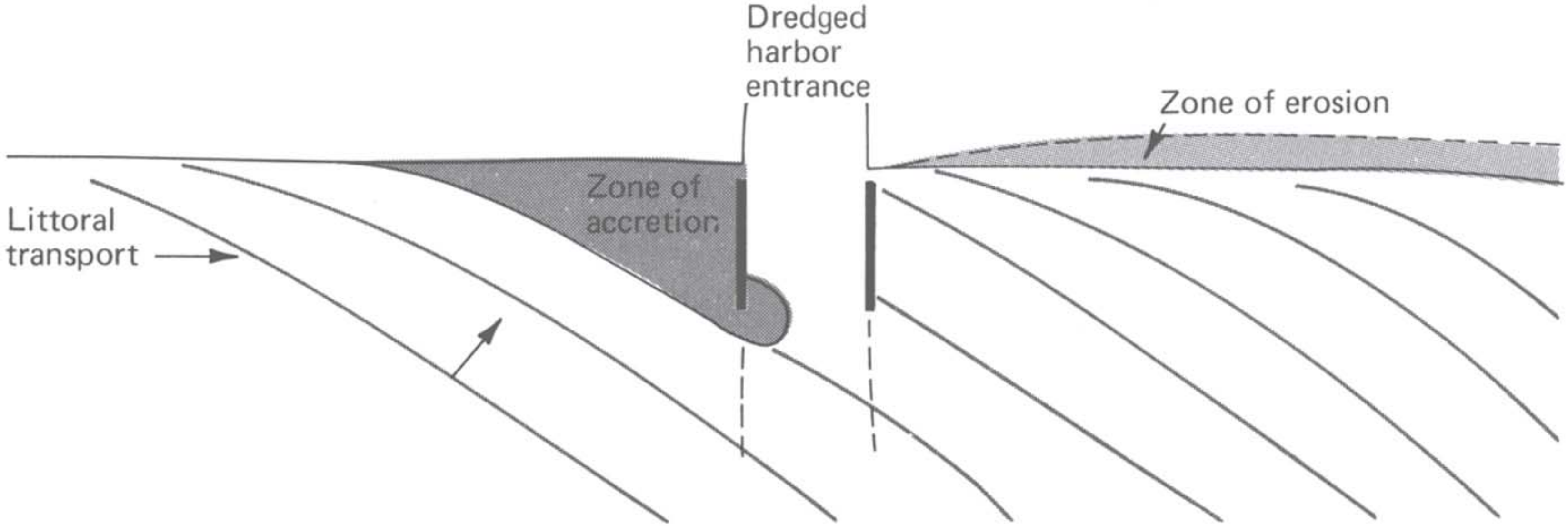
Deposit sediment on upcurrent side, erode beach on downcurrent side



Deflects longshore transport farther offshore



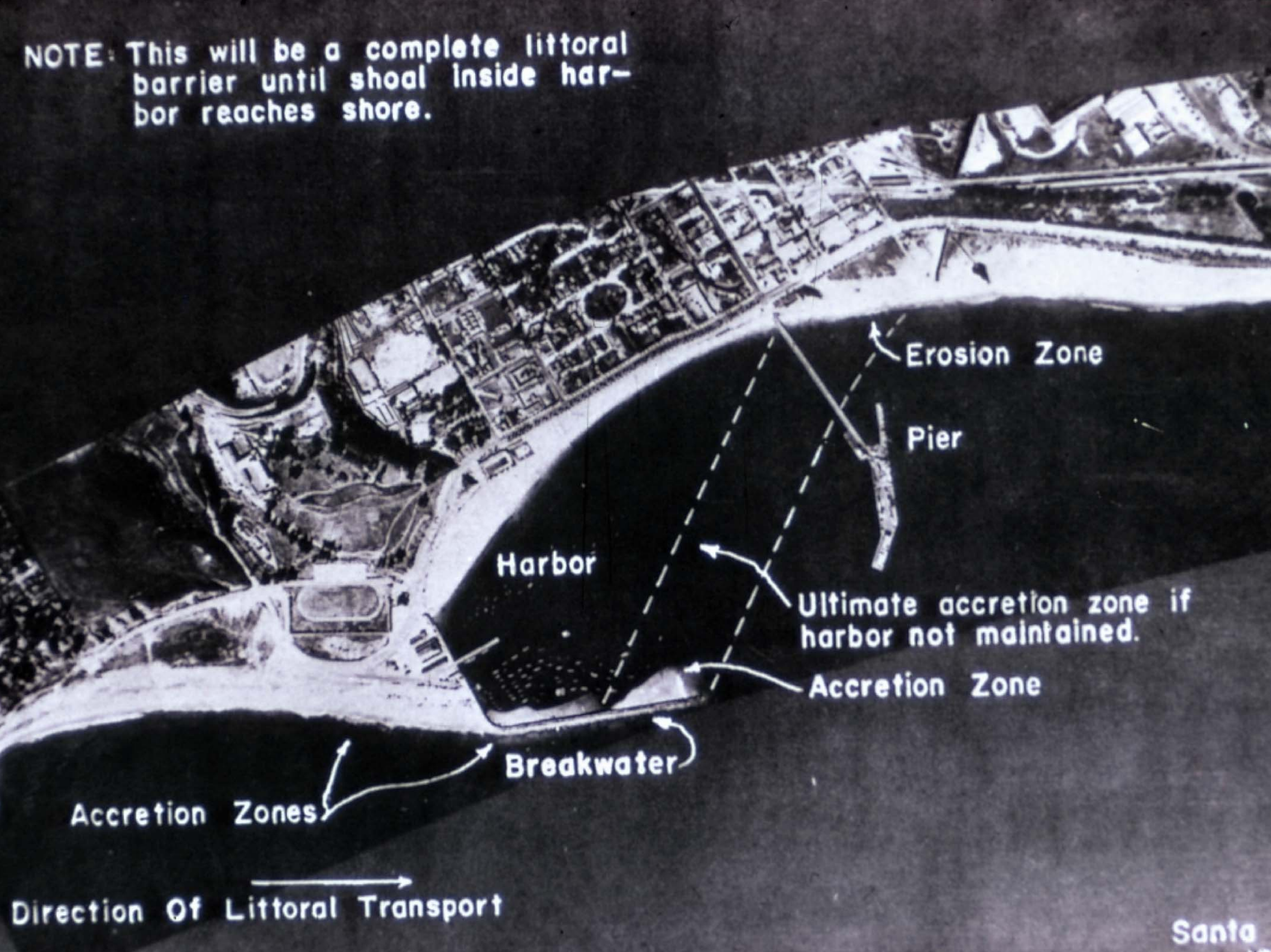
Jetty entrapment of sediment

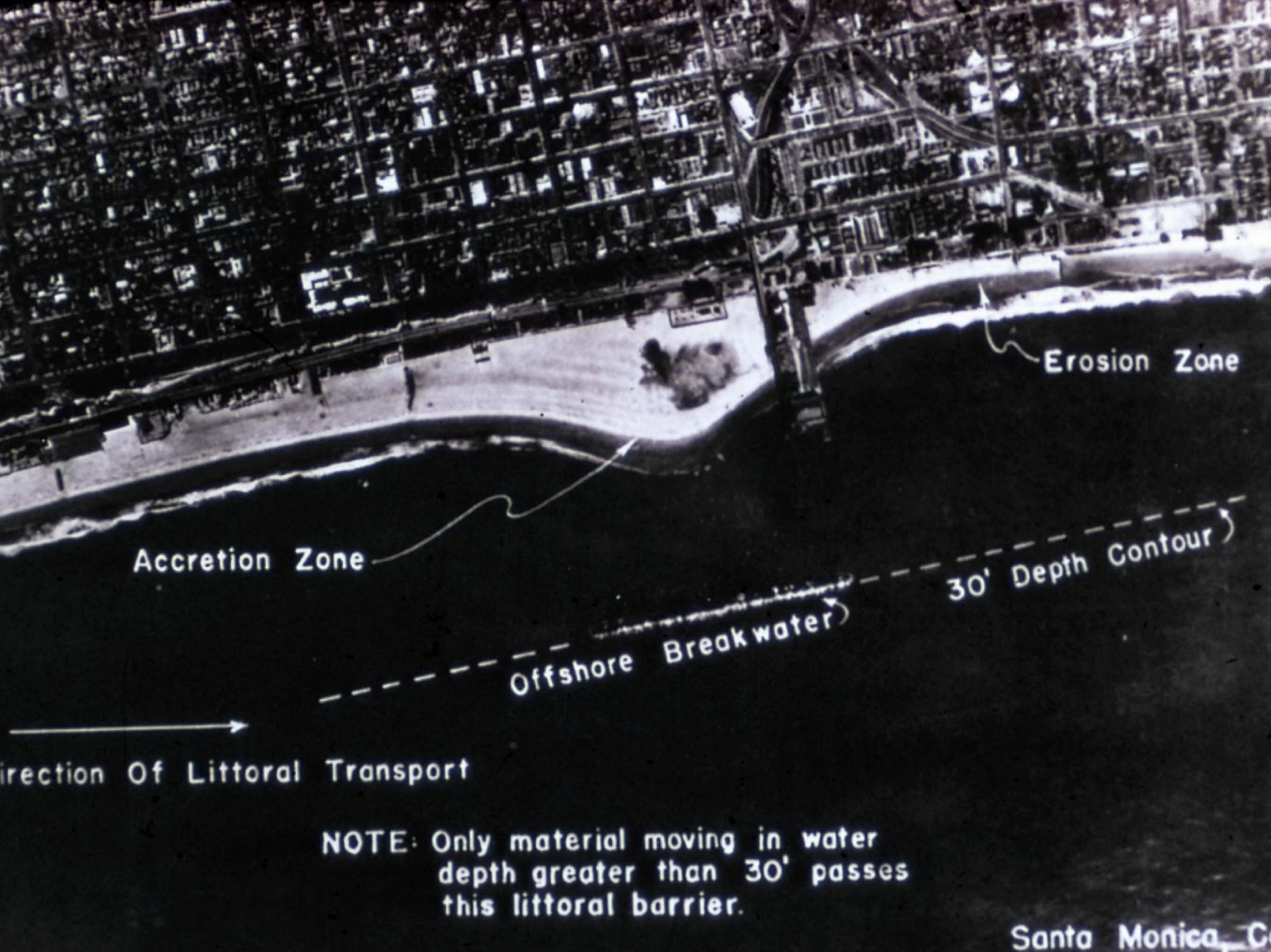


Sediment trapped on upstream side, due to longshore transport

Loss of sediment causes erosion on downstream side, to resupply longshore transport system

Similar to entrapment associated with groins, but on larger scale


NOTE: This will be a complete littoral barrier until shoal inside harbor reaches shore.
Erosion Zone
Pier
Harbor
Ultimate accretion zone if harbor not maintained.
Accretion Zone
Breakwater
Accretion Zones
Direction Of Littoral Transport
Santa


Erosion Zone
Accretion Zone
30' Depth Contour
Offshore Breakwater
irection Of Littoral Transport
NOTE: Only material moving in water depth greater than 30' passes this littoral barrier.
Santa Monica, C

Human Beach Structures