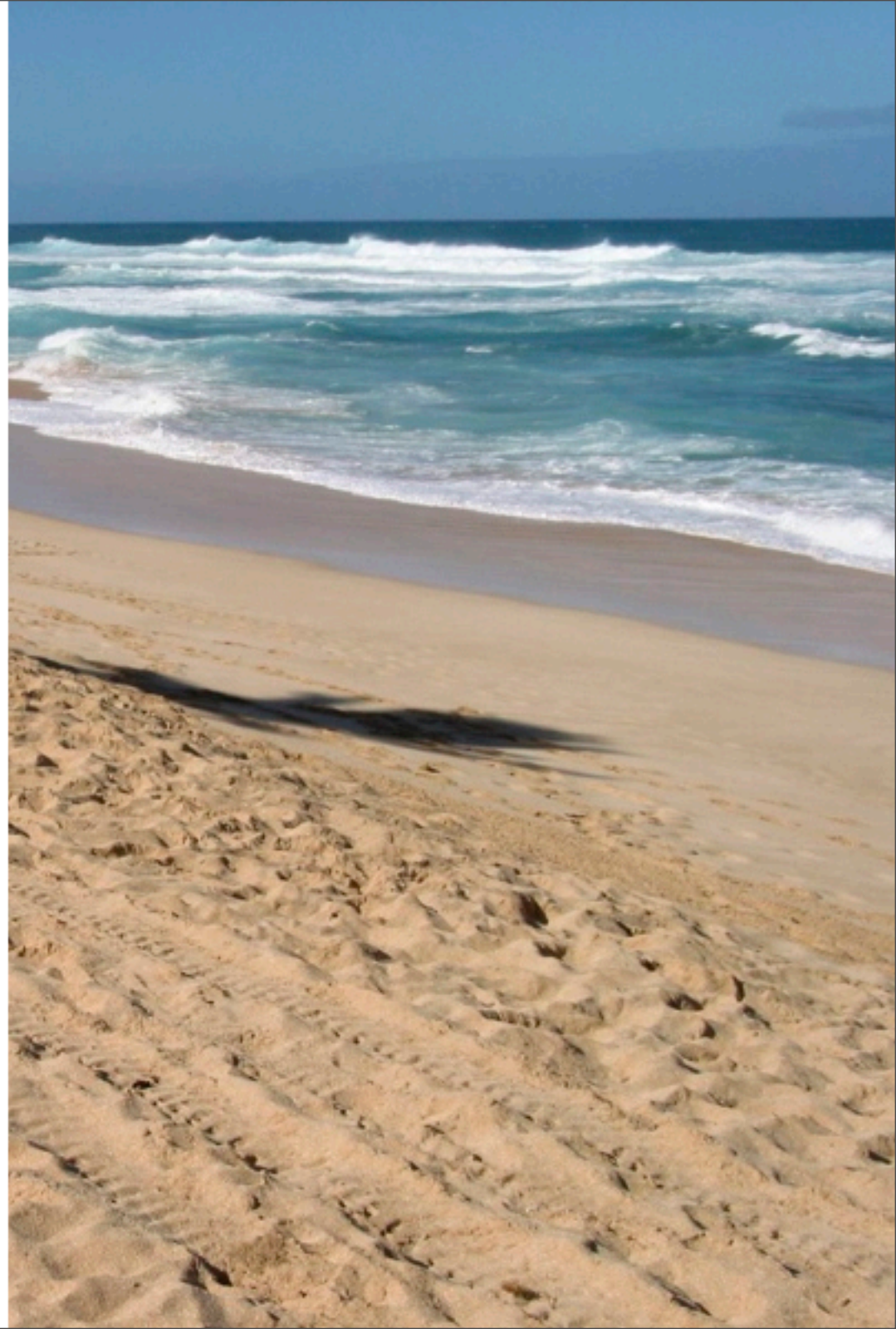


Beaches

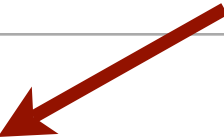
Coastal Oceanography of Hawai'i

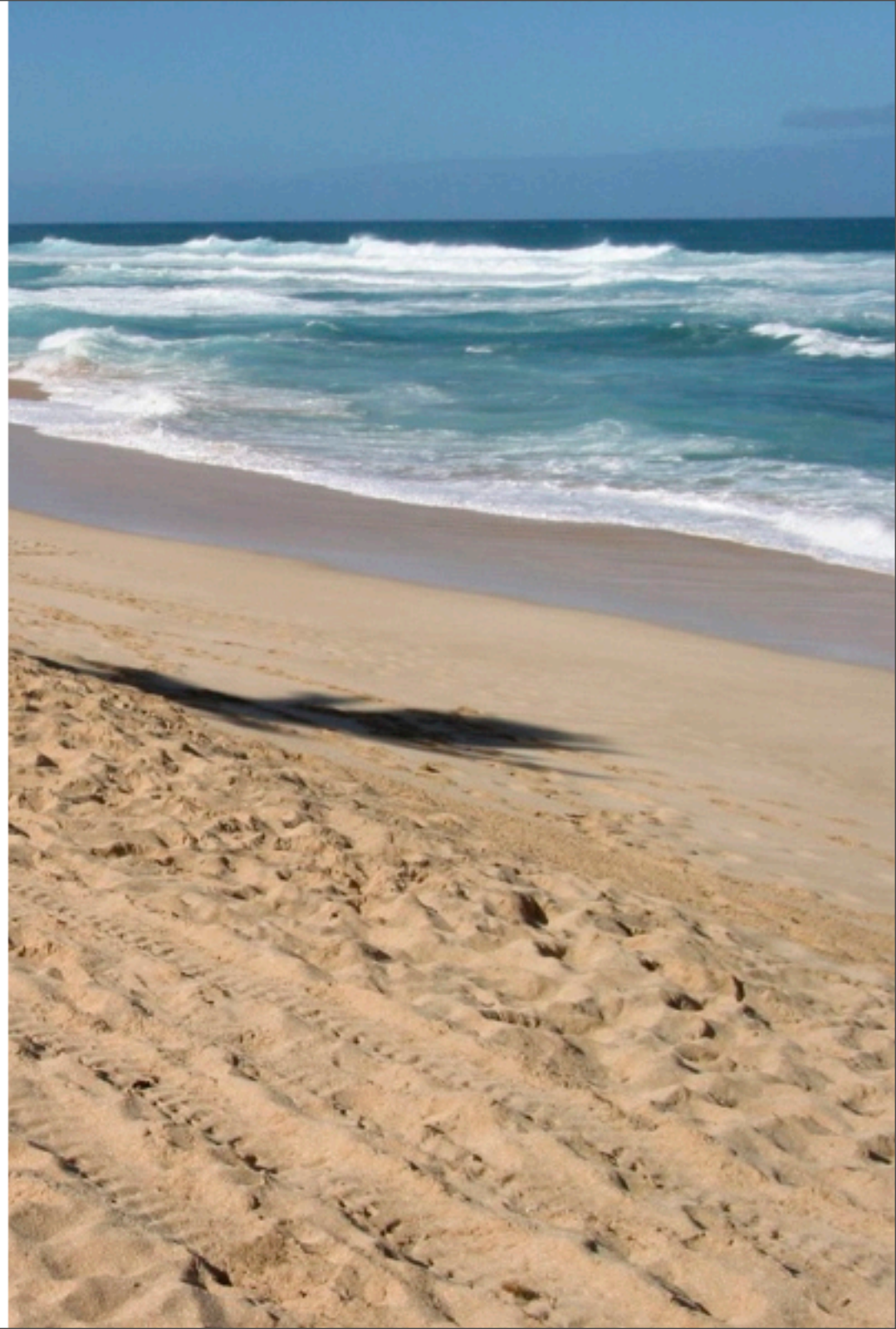
Topics

- Beaches
- Sand
- Longshore Drift and Groins
- Seawalls and Beach Loss



Topics

- Beaches 
- Sand
- Longshore Drift and Groins
- Seawalls and Beach Loss



Beaches

Beaches

Hawai'i beaches come from the ocean

White Sand Beaches

White Sand Beaches

- Most common type of beach in Hawai'i

White Sand Beaches

- Most common type of beach in Hawai'i
- Biogenous marine sediment

White Sand Beaches

- Most common type of beach in Hawai'i
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- Biogenous - formed by living organisms

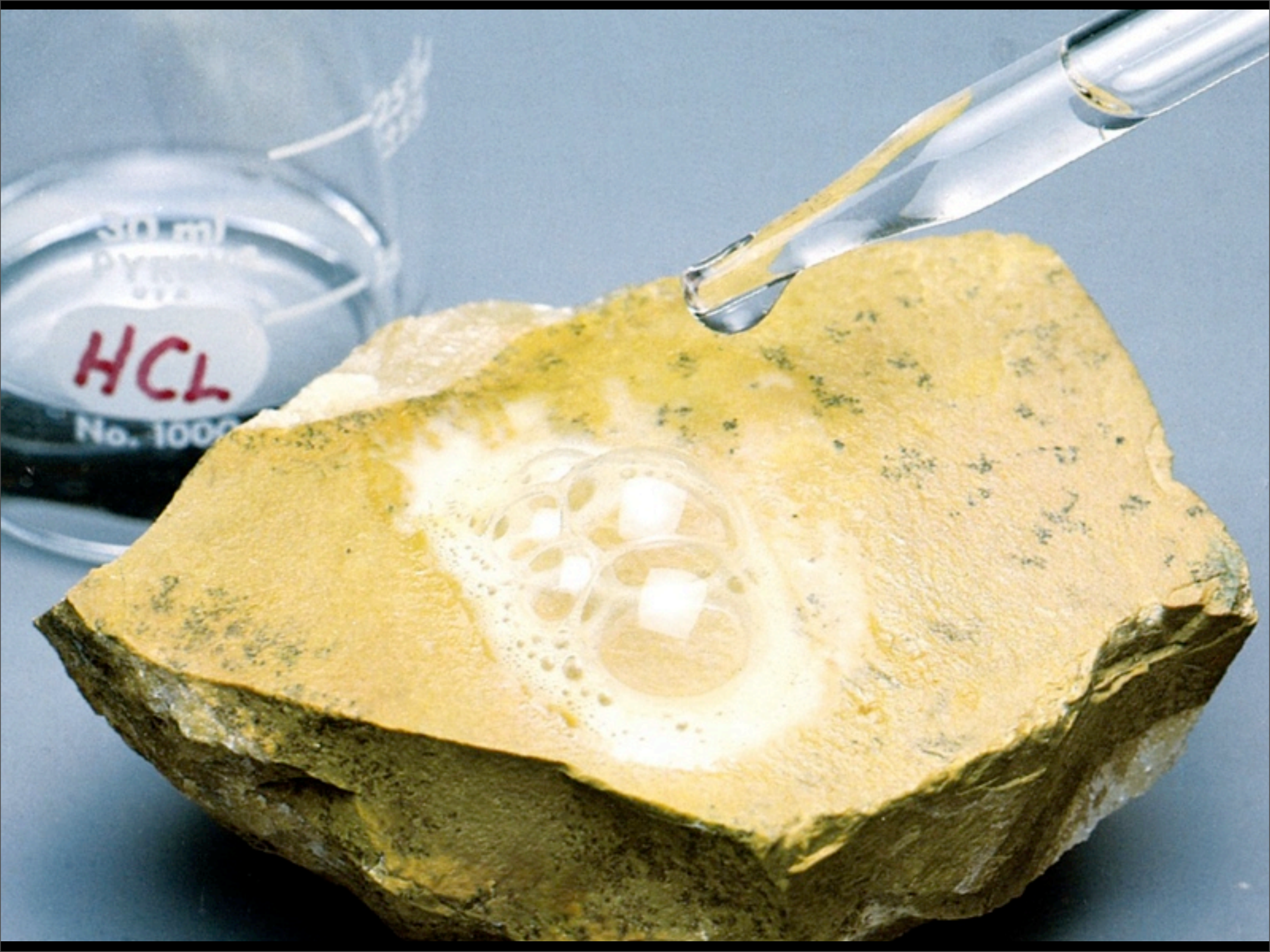
White Sand Beaches

- Most common type of beach in Hawai'i
- Biogenous marine sediment
- Biogenous - formed by living organisms
- Chemical composition is CaCO_3



Sunset Beach





CaCO_3 effervesces in acid



Calcareous Sand

Calcareous Sand

- Biogenous sand forms from the hard parts of marine organisms

Calcareous Sand

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- Organisms live on the reef

Calcareous Sand

- Biogenous sand forms from the hard parts of marine organisms
- Organisms live on the reef
- When they die, waves rolls their shells to the shore



Breaking waves transport sand to shoreline



Beach Profile

Beach Profile

- Beach profiles change seasonally

Beach Profile

- Beach profiles change seasonally
- Large winter waves transport sand offshore

Beach Profile

- Beach profiles change seasonally
- Large winter waves transport sand offshore
- Winter profiles are narrow and steep

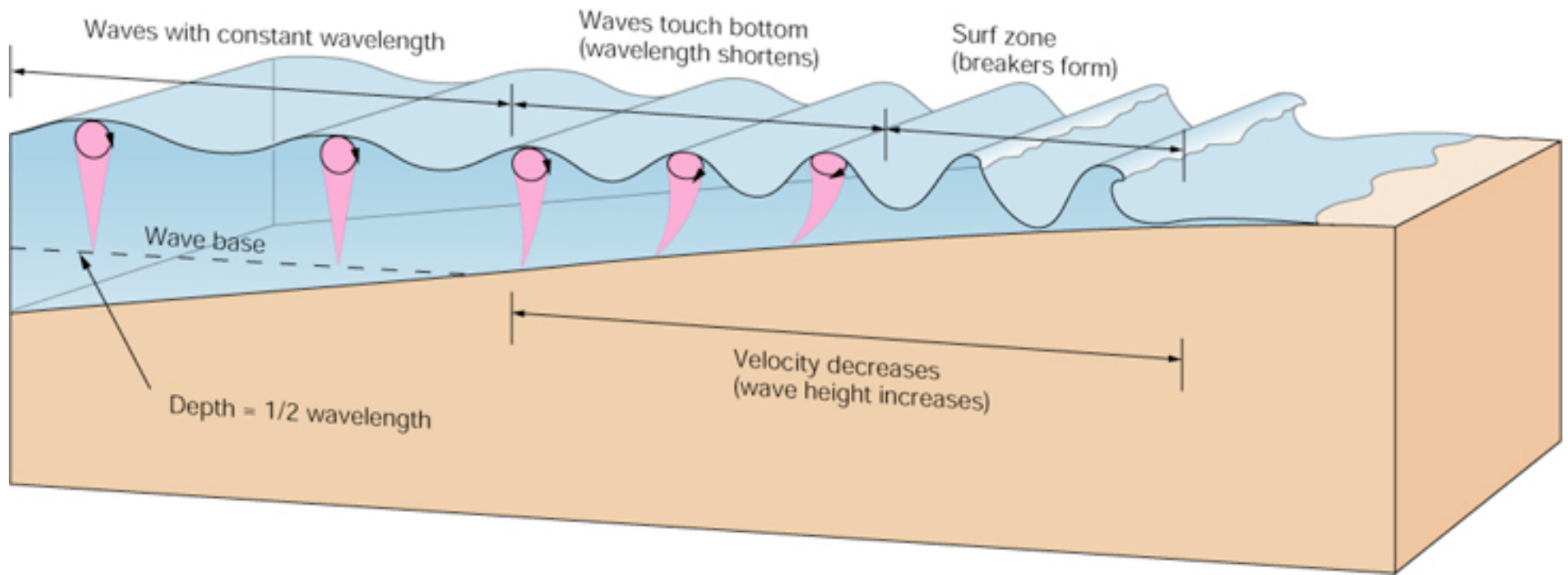
Beach Profile

- Beach profiles change seasonally
- Large winter waves transport sand offshore
- Winter profiles are narrow and steep
- Small summer waves transport sand onshore

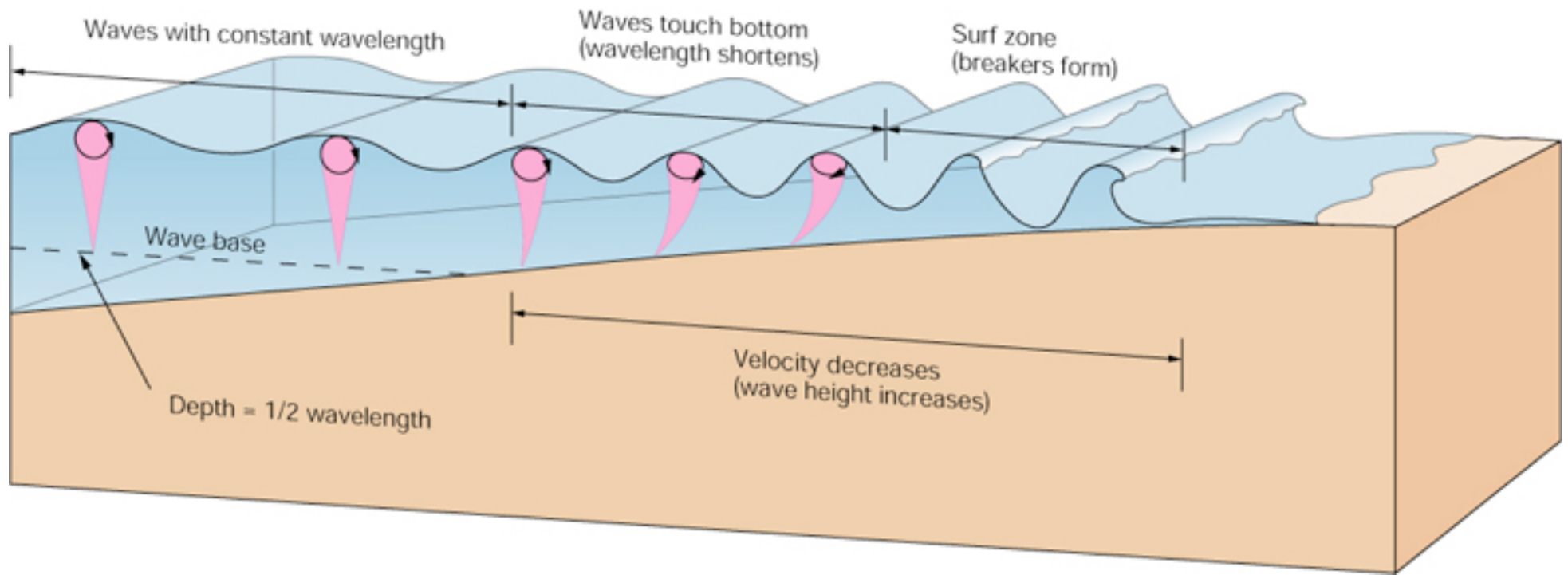
Beach Profile

- Beach profiles change seasonally
- Large winter waves transport sand offshore
- Winter profiles are narrow and steep
- Small summer waves transport sand onshore
- Summer profiles are wide and less steep

Wave Base



Wave Base



- Waves stir the ocean to $1/2$ wavelength

Sand Loss

Sand Loss

- Large waves stir ocean deeper than small waves

Sand Loss

- Large waves stir ocean deeper than small waves
- Winter waves transport sand into water too deep for summer waves to return to shore

Sand Loss

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Sand Loss

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- For beaches to remain at steady state,
 - $\text{inputs}_{\text{(sand)}} = \text{outputs}_{\text{(sand)}}$

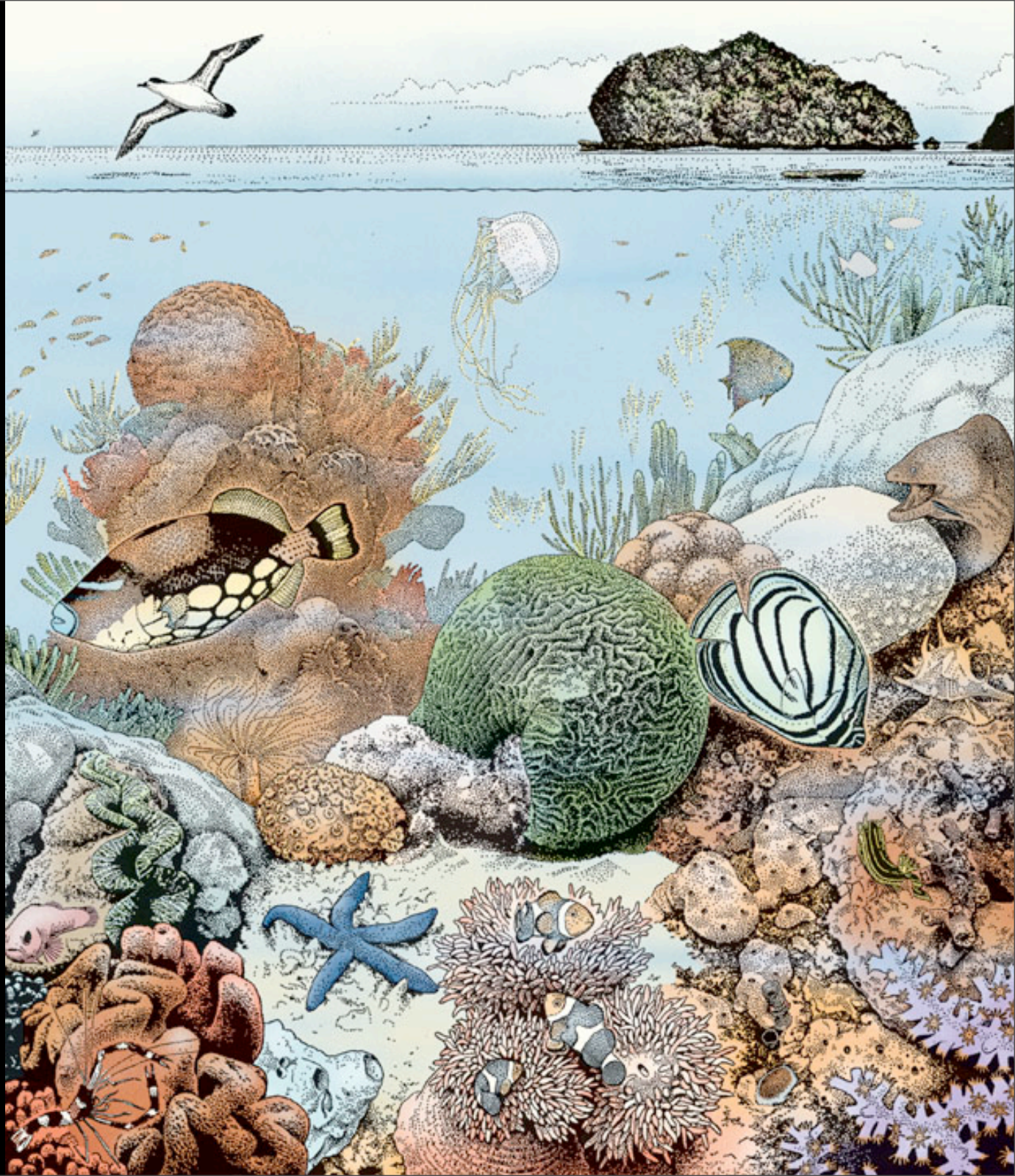
Healthy Reefs

Healthy Reefs

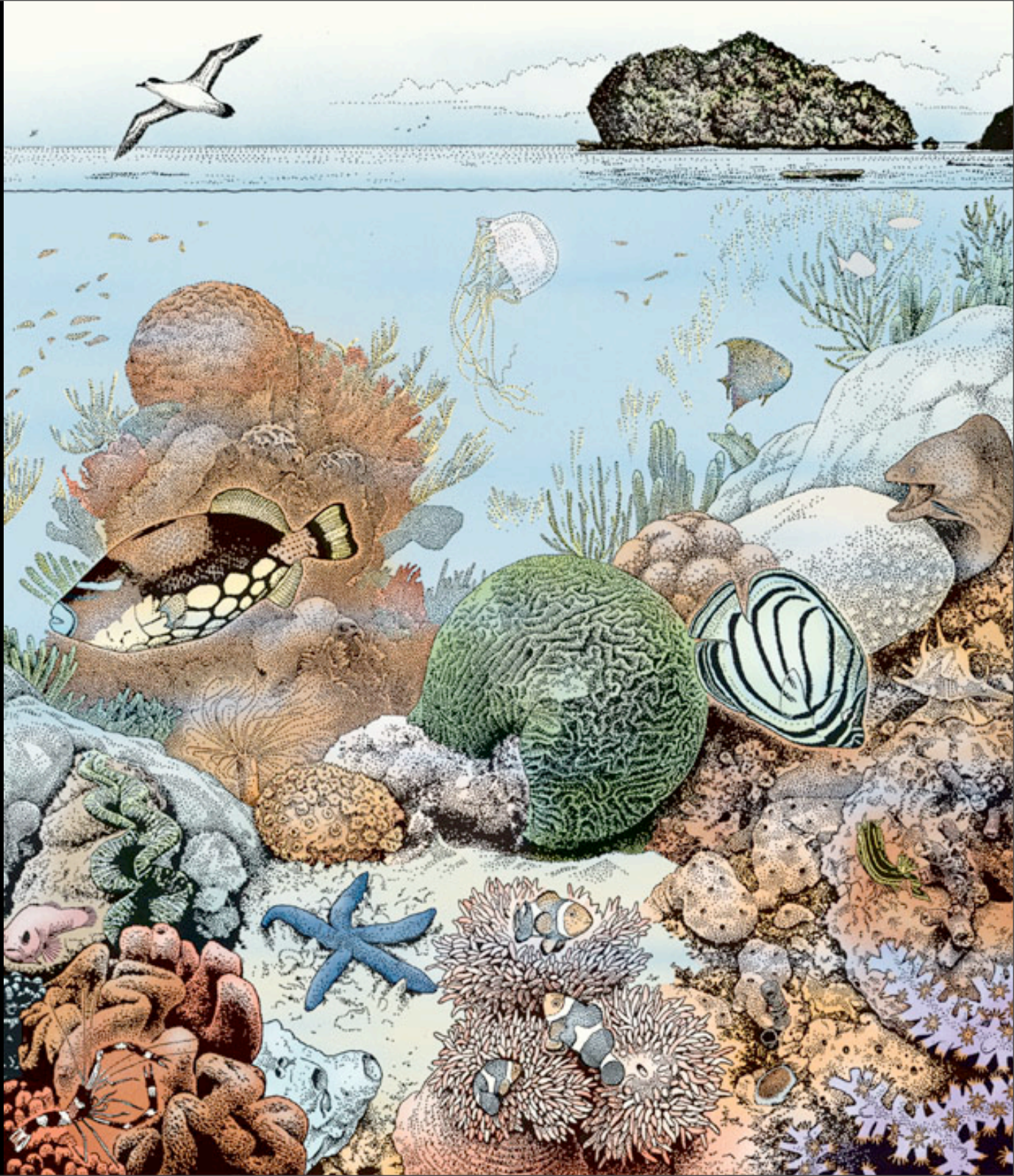
- Hawai'i sand comes from ocean

Healthy Reefs

- Hawai'i sand comes from ocean
- A constant supply of sand requires a healthy reef system



- Reefs require clean, clear water



Next

Sand Exercise