

## In-Class Exercise: Shorelines and Wave-cut Terraces

Objective: To model coastal terrace development using a stream table.

Materials: stream table, wave generator, ruler, protractor, colored sand, toothpicks, transparency, markers.

### A - Shoreline Development

- (1) Pile sand into a steeply sloping mound (30-45 degrees) across the center of the stream table.
- (2) From the base of the mound, form a gently sloping shelf, towards the bottom of the stream table.
- (3) Fill the bottom shelf with water, to a level one-third the distance from the top of the mound.
- (4) Position the wave generator at the end of the stream table and direct waves toward the shore at a 90 degree angle.
- (5) Run the wave generator for 10-15 minutes, until the shoreline landforms have stabilized.

Record the following results:

- Describe your general observations regarding the processes occurring at the shoreline interface. Make a sketch and identify sea cliff, wave-cut platform, and shoreface terrace.

- Fill in the data chart below:

Angle of Sea Cliff	_____
Angle of Wave-Cut Platform	_____
Angle of Shoreface Terrace	_____

### B - Terrace Development

- (1) Drain the water so that levels are at the lower portion of the sand mound.
- (2) When the water has quieted, insert toothpicks or other markers along the "strand line" of the beach (i.e. along the water-shore interface).

(3) Turn on the wave generator. For the first 3 minutes, record the distance between toothpicks (at the strand line) to the developing sea cliff. Observe whether the distance is the same for all toothpicks. Fill in the chart below.

Time	Distance from Original Strand Line to Sea Cliff
30 sec	_____
60 sec	_____
90 sec	_____
120 sec	_____
150 sec	_____
180 sec	_____

(4) Continue to run the wave generator for about 20 minutes.

(5) Sprinkle colored sand on the abrasion platform, turn the wave generator at an oblique angle. Make observations regarding particle movement and long shore drift.

Observations Here:

(6) Once the new sea cliff has stabilized, fill in the chart below for the lower wave cut platform:

Angle of Sea Cliff	_____
Angle of Wave-Cut Platform	_____
Angle of Shoreface Terrace	_____

Answer the following questions:

1. Why are sea caves, arches, and stacks formed on a natural shoreline when they are not produced on the stream table?

2. What type of coastal configuration is necessary for the development of sea caves, arches, and stacks? Which are they more likely to form on: Emergent or Submergent Coasts? How about tectonically active vs. passive margin coasts?

3. How are the sides of the tank affecting the development of the stream table shorelines? Discuss your answer in terms of wave reflection, refraction and interference.
  
4. Why is the abrasion platform nearly flat?
  
5. Explain the development of the wave-cut platform. What was the movement of the sand grains on the abrasion platform while the waves were approaching at 90 degree angles? How is this particle movement related to the building of a wavecut terrace and "wavebuilt" terrace? On which side of the toothpicks did each of these features form?
  
6. Explain how a sea cliff, much higher than the incoming breaking waves, is eroded. How is this similar to the erosion of a waterfall / stream knickpoint as it develops on resistant bedrock?
  
7. What is the geomorphic record of change in water level of the stream table. How can we determine relative changes in sea level without actual water depth measurements?
  
8. Why is the material eroded from the face of the sea cliff important in further erosion?
  
9. Did you observe any offshore bar or other deposits in the experiment? If so, explain how these bars formed (what was the process - draw a diagram).

10. From your observations of sea cliff erosion, explain how a guyot is formed.

11. From your timed measurements of the distance from the toothpicks to the sea cliff, when was the speed of erosion greatest and why?

12. A series of elevated shorelines indicates a relative fall of sea level or elevation of the land. List tectonic and eustatic scenarios that lead to such changes.

13. What would you expect to find on a submerged slope after a relative rise of sea level in several stages? Draw a cross-section showing 3 stages of coastal submergence. Would the time it took for these changes to occur change your answer?