

Name: \_\_\_\_\_ Laboratory Section: \_\_\_\_\_  
Date: \_\_\_\_\_ Score/Grade: \_\_\_\_\_

**Video**  
Exercise 26  
Pre-Lab Video



<http://goo.gl/Q200B1>

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Pre-Lab video



## LAB EXERCISE

# Topographic Analysis: Coastal and Arid Geomorphology and Sea-Level Rise

## Lab Exercise and Activities

### SECTION 1

## Coastal Features and the Duncans Mills and Arched Rock Topographic Map and Aerial Imagery

**Virtual Tour**  
Duncans Mills  
and Arched  
Rock, CA



<https://goo.gl/BMQ3gX>

Activities and completion items related to coastal geomorphology:

1. Refer to **Figure 26.6** Topographic Map of Duncans Mills and Arched Rock, CA and **Figure 26.8** Aerial Imagery of Duncans Mills and Arched Rock, CA.

- a) What is the scale of this map? 1:24,000
- b) What is the contour interval? 40'

2. What type of feature is Goat Rock? is it an erosional or depositional feature? What type of feature would it be if it wasn't connected to the mainland by sediment?

*Tombolo, sea stack.*

3. What type of feature is found between Jenner Beach and Goat Rock? Describe how it appears and how it differs from other similar features.

*Bay barrier. It cuts the bay off from the ocean. If there was a gap for the river it would be a barrier spit.*

4. List and name three erosional and depositional features found in Figure 26.6. Circle and label them on Figure 26.6.

*Student answers, but could include sea stack, wave cut terrace, sea cliffs, beach.*

5. If you were in a small boat off of Jenner Beach and wanted to come ashore, would you come ashore on the north or south end of Jenner Beach? Why? Using the topographic map symbol key on the inside front cover of your lab manual, what are the features offshore from Jenner Beach?

*South of Jenner Beach because of the rocks off shore north of Jenner Beach.*

6. Marine terraces are remarkable indicators of an emerging coastline. What evidence do you find of such a leveled terrace on the map? Describe where the terraces are and at what elevation.

*There's a marine terrae that the road runs along between Russian Gulch and Jenner Beach.*

7. Circle and label some wave-cut cliffs along the coast on Figure 26.6. Using the contour lines, how high above sea level are they north of Russian Gulch? . . . south of Goat Rock?

*Student activity*

8. Describe some specific differences you see in comparing the map and the photos. Are there any cultural features that appear on the photos and not on the map? Describe.

*The photos show buildings, roads, and cleared land under a power line.*

9. Optional Google Earth activity, Duncans Mills, California. For the KMZ file and questions, go to mygeoscienceplace.com or the Mastering Geography Study Area. Then click on the cover of *Applied Physical Geography: Geosystems in the Laboratory*.

## SECTION 2

### Sea Level Rise in Miami, FL

1. Compare the rate of sea-level rise at Virginia Key in Florida from 1994–2016 with the average rate from 1993–2013. What was increase per year at Virginia Key? What was the average rate?

*Virginia Key sea-level rise from 1994–2016 has been 0.22" per year, while from 1993–2013 average sea-level rise was 0.14".*

2. If sea level at Virginia Key continued to rise at that same rate from 2016 on, how much higher would sea level be in 2100 at Virginia Key? How does that rise compare with the estimated intermediate and extreme projections shown in **Table 26.1**? Based on these answers, is the rate of sea-level rise increasing or decreasing?

*18.26" (.46 m) by 2100. The intermediate and extreme projections are for 1.1 m and 3.6 m. Increasing.*

One of the highest storm surges recorded along the east coast was during the Great Miami Hurricane of 1926, a category 4 hurricane with sustained winds of 150 mph. 11.7 feet (3.6 m) of storm surge was recorded along Biscayne Boulevard in downtown Miami. We'll assume another storm of this magnitude for this exercise.

Table 26.1 shows projected sea level rise data for Miami, FL. **Figure 26.7** shows current elevation above mean high water for the Miami Beach area. That is, the elevations shown represent the elevation above the average high tide, not above mean sea level. **Figure 26.9** is a topographic map of the same region.

3. Use a dark blue colored pencil or pen to draw the approximate locations of the following on Figure 26.7: the region that will be inundated under the extreme projection by 2040, 2060, and 2100. Use a red pencil or pen to draw the approximate location of the boundary of the region that could be inundated by extreme sea level rise and storm surge in 2100.

*Student activity.*

**TABLE 26.1** Projected sea level rise for Miami, FL

Year	Intermediate	Extreme	Extreme Storm Surge	Extreme Sea Level Rise + Extreme Storm Surge
Current			11.7 ft (3.6 m)	
2040	1.05 ft (0.3 m)	2.00 ft (0.6 m)	11.7 ft (3.6 m)	13.7 ft (4.2 m)
2060	1.8 ft (0.5 m)	4.00 ft (1.2 m)	11.7 ft (3.6 m)	15.7 ft (4.8 m)
2100	3.8 ft (1.1 m)	10.4 ft (3.2 m)	11.7 ft (3.6 m)	22.1 ft (6.7 m)

4. Circle the following locations on Figure 26.9 and list their current elevation above sea level and the depth of water at that location under the extreme scenario:

Name	Current elevation	Water depth in 2100
a) The Miami Seaquarium on Virginia Key	<u>&lt;5'</u>	<u>5'</u>
b) Dodge Island (The Port of Miami)	<u>&lt;5'</u>	<u>5'</u>
c) The water treatment plant on the north end of Virginia Key	<u>10'</u>	<u>0.4'</u>
d) The islands along Venetian Way between Miami and Miami Beach	<u>5'</u>	<u>5'</u>
e) The city cemetery	<u>10'</u>	<u>0.4'</u>

5. How far inland in the city of Miami would you go to find a location with an elevation higher than 15'?

*Over two miles in the north, to under 800' in the south.*

6. Can you find any locations in Miami north of the Miami River, east of Highway 95, and south of Highway 195, with an elevation that is higher than the projected extreme sea level rise in 2100? extreme sea level rise with storm surge in 2100?

*Yes, but they many of the locations look like road overcrossings.*

7. Can you find any locations in Miami Beach with an elevation that is higher than the projected extreme sea level rise in 2100? extreme sea level rise with storm surge in 2100?

*Just around teh 195/907 interchange.*

8. Will the effects of sea level rise be greater in Miami or Miami Beach? Explain your answer and provide examples.

*Greater on Miami Beach because of it's lower elevations.*

9. What do you think the future holds for the real estate market in Miami?

*Personal answers*

## SECTION 3

### Death Valley, California

#### Condor Characteristics of Alluvial Fans



<https://goo.gl/YjqXQT>

#### Mobile Field Trip Desert Geomorphology



<https://goo.gl/muobfN>

#### Virtual Tour Death Valley



<https://goo.gl/s08ua5>

Analysis and completion items for **Figure 26.10**, Topographic Map of Death Valley, CA, and **Figure 26.12**, Aerial Imagery of Death Valley, CA:

1. This topographic map has two different contour intervals. What is the contour interval for elevations below 1000 ft.? What is the contour interval on this map for elevations over 1000 ft.? How would the upper elevations look if they had been mapped with the same contour interval as the lower elevations? How would the lower elevations look if they had been mapped at the same contour interval as the higher elevations?

*Over 1000' the interval is 200', under 1000' the interval is 40'. The upper elevations would be too dark, the lower elevations would lack detail.*

What is the scale of this map?

*1:150,000*

2. Although Death Valley receives less than 5 cm (2 in.) of rain each year, water is an important agent in modifying the landscape. List by name at least three water features formed by running or standing water (not springs) and trace or outline them on the topographic map with a blue colored pencil or pen.

*Personal answers, but could include Salt Creek, Texas Springs, Travertine Springs, Furnace Creek.*

3. Using a black colored pencil or pen, label the following features on **Figure 26.10**: bajada, alluvial fan (may be part of a bajada), playa, and graben.

*Student activity.*

4. Alluvial fans are important sources of water in arid climates. Rain from storms percolates through the alluvium of the fan before reaching an impermeable layer. Some of the signs of this are springs and vegetation at the bottom of alluvial fans. Identify by name at least four locations on Figure 26.10 with springs or vegetation and circle them on the topographic map with a blue colored pencil or pen.

*Student activity.*

5. Use **Figure 26.4** to plot the topographic profile along the 36° 20' N parallel. The 36° 20' N parallel is not marked on the map, but there is a tick mark on the map at 36° 20' N on the west side of the map. Start your profile at the 36° 20' N tick mark just north of Trail Canyon on the west and proceed east across the valley to the 800-ft elevation contour on Figure 26.9, Topographic Map of Death Valley, CA.

*Student activity.*

6. What is the linear distance from the 1400-ft elevation contour in Trail Canyon to the 200-ft contour? What is the relief between these two points?

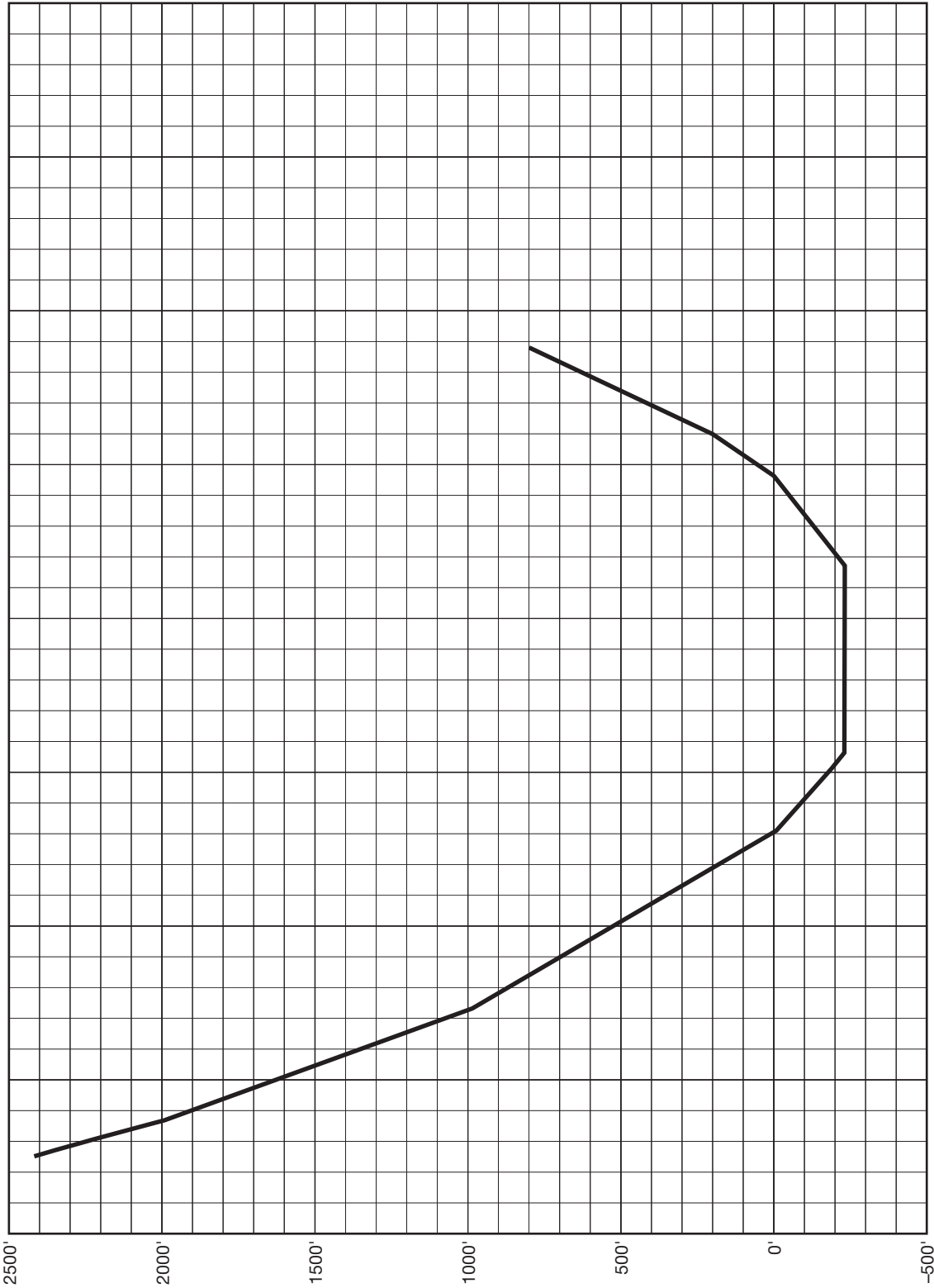
*8.2 miles, 1200'*

In terms of slope, state this distance and relief in meters per kilometer:

*366 m in 13.1 km = 30 m/km*

State this in terms of percent grade:

*3%*



▲ Figure 26.4 Topographic profile across Death Valley, CA

- Using a black colored pencil or pen, trace the outline of the alluvial fan at the mouth of Trail Canyon. What is the lowest-value elevation contour line on the fan? Using a blue colored pencil or pen, trace the streams on the Trail Canyon alluvial fan.

**Student activity.**

- Briefly describe how alluvial fans are formed. Why do you think there is more than one stream on the Trail Canyon alluvial fan? Relate your answer to the process by which alluvial fans are formed.

*The fan is produced by flowing water that loses velocity as it leaves the constricted channel of the canyon and, therefore, drops layer upon layer of sediment along the base of the mountain block. Water then flows over the surface of the fan and produces a braided drainage pattern, shifting from channel to channel with each flood event.*

- Explain why you think the alluvial fans on the west side of Death Valley are larger than the alluvial fans on the east side of Death Valley.

*Larger watersheds would produce larger fans.*

- Identify two features that are more obvious in Figure 26.10 Topographic Map of Death Valley, CA, than in Figure 26.12 Aerial Imagery of Death Valley, CA, and two figures that are more obvious in the aerial imagery than in the topographic map.

**Personal answers.**

- Optional Google Earth™ activity, Cedar Creek Alluvial Fan in Ennis, Montana. For the KMZ file and questions, go to mygeoscienceplace.com or the Mastering Geography Study Area. Then click on the cover of *Applied Physical Geography: Geosystems in the Laboratory*.

## SECTION 4

### Mitten Buttes, Arizona, Quadrangle and Aerial Imagery



- What is the contour interval on this map segment?  
**20'**  
What is the scale of this map?  
**1:27,000**
- What is the elevation of the Monument Valley Visitor Center? What is the relief between the top of Mitchell Mesa on the west side of the map and the lower elevations along the east side of the map?  
**5580', top of Mitchell 6480', lower elevations 5200', relief is 280'**
- Which is the tallest named butte? What is its elevation?  
**Merrick Butte, 6200'**
- Examining these features on the topo map and in the aerial imagery, can you describe any features that indicate differing rock resistances to weathering (slopes = less resistance; cliffs = more resistance)? Describe and explain.  
**Steep slopes and flat topped buttes and mesas.**
- Use a dark blue pencil or pen to draw an arrow in the direction of flow of West Gypsum Creek. Which type of stream is West Gypsum Creek?  
**Student activity, intermittent stream.**

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6. Earlier we stated that water is the major erosional force in the desert; although occurring infrequently, when it rains, the downpour is usually intense, and floods flash across the sparsely vegetated surfaces swiftly. Given this reality, and using the map and aerial imagery, describe several examples that demonstrate to you that water is the major erosional force and is occurring infrequently. List at least four examples (look for dry washes, sharp features, and alluvial deposits). Name at least one type of feature that is missing from the Mitten Buttes map that is present on the Death Valley map.

*Personal answers, but could include dry washes,*

7. Optional Google Earth™ activity, Mitten Buttes, Arizona. For the KMZ file and questions, go to [mygeoscienceplace.com](http://mygeoscienceplace.com) or the Mastering Geography Study Area. Then click on the cover of *Applied Physical Geography: Geosystems in the Laboratory*.