Virtual Field Trip to Upper Texas Coast

Physical Geology GEOL1303 Spring 2022 Extra Credit Assignment

Name:
myUH ID number:
Professor’s Name:
Class Time:

Academic Honesty (Signature Required)

The Virtual Field Trip to Upper Texas Coast is to be completed by yourself; you should not work with a partner or group. Do not search for answers on the internet because 1) it is cheating; 2) answers that are posted are incorrect and we’ll know where you got them from and 3) the questions change every semester. Be careful if you watch the videos with closed captioning because the spelling of geologic terms is often incorrect or misinterpreted by the captioning software, so you may end up with a wrong answer. If you are unfamiliar with a word or geologic concept, it is okay to look it up online or and find the correct spelling and definition. If you need help, physical geology teaching assistants staff the Geoscience Learning Center team in Fleming 136.

By submitting this work, I, Type Your Name Here attest that I have not violated the UH Academic Honesty code. I completed this assignment by myself and did not copy any portion of my answers from another student, a website, or any other source. In addition, I will not upload any of my answers to any electronic media such as Course Hero, SnapChat, Chegg, etc.

Assignment Submission

Save your completed written assignment as “yourlastnameFirstname_VFTUpperTXcoast”. Email your file to eas.uh.physical.geology@gmail.com. You will not get a confirmation that it has been received.

Teaching Assistants will begin grading submissions after the deadline in early December 2021. You will receive an email from a TA when your assignment is graded. If your assignment requires resubmission, you will have 48 hours to do so.

How the virtual field trip works.
There is an interactive field trip with a map of locations for each stop you will visit. First, you need to watch the introductory video by clicking on the red video icon located near University of Houston. Then, you should click on each stop (green circle). This will take you to an immersive 360 panorama. Use your
mouse to explore the entire area. Within the 360 panorama, pay attention to icons that will take you to either videos and/or panoramas. Use the navigation bar at the bottom to come back to the map and move to other stops. The stop order is:

Stop UH  Welcome to the Coast Virtual Field Trip and Methods in the field
Stop 1   Brazos river
Stop 2   Modern Brazos river delta
Stop 3   Paleo Brazos river delta
Stop 4   Galveston State Park Beach and Bay side
Stop 5   Galveston Seawall
Stop 6   Galveston NE end

Welcome to the Coast Virtual Field Trip and Methods in the field

When a geologist goes on a field trip or does their field research, they take notes and make sketches of what they see and try to interpret these rocks (outcrops). So, to do this field trip you will be asked to take notes on what you see using both the videos and 360° images. The first step at every outcrop is to identify if you are looking at igneous, metamorphic or sedimentary rocks. Then, describe features of the rocks and possibly sketch them. After describing the rocks, you need to describe any deformation that has occurred. The general process for writing rock descriptions is to start off with a general description (color, grain size, texture, etc.), followed by identification of the minerals within the rock (the mineral assemblage), the name of the rock (deduced from the assemblage) and then finally your interpretation on how and where it was formed. If you need help describing rocks, your text has many figures that are helpful. We've noted many of the figures for each stop. All figures referred to are from Earth, 12th Edition by Tarbuck, Lutgens, and Tasa. All answers should be written as full sentences and not one or two words. Most of the Google Earth imagery is done in 2018 except as noted.

EXERCISE 1 In the Google earth image of the Texas coast (Figure 1) identify the different coastal elements, listed below. Use Figure 2 with the definitions below. Mark these on the image.

1. Coast
2. Bay
3. Nearshore
4. Offshore
BACKDUNE

It is the dune area behind the foredunes, after the trough. The backdune is usually forested and provides shade to its inhabitants. The backdune provides cool temperatures and moist soil adequate for many plants and animals.

BACKSHORE

Zone that is dry under normal conditions, it is characterized by present of berms and it has no vegetation. The backshore is only exposed to waves under extreme events with high tide and storm surge.

BERM

Terrace of a beach that has formed in the backshore, above the water level at high tide. Berms are commonly found on beaches that have fairly coarse sand and are the result of the deposition of material by low-energy waves.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>COAST</td>
<td>It is the strip of land that extends from the coastline landward to the first major change in the terrain features, which are not influenced by the coastal processes.</td>
</tr>
<tr>
<td>DUNE</td>
<td>Ridges of loose, wind-blown sand (fine to medium) forming on the backshore.</td>
</tr>
<tr>
<td>FOREDUNE</td>
<td>It is the dune area directly behind the beach. The sand dunes are usually covered by grass, that help stabilize the sand.</td>
</tr>
<tr>
<td>INTERDUNE</td>
<td>It is the depressed area between the foredune and the backdune. The trough often fills with groundwater causing interdunal ponds where many organisms survive in this more stable habitat.</td>
</tr>
<tr>
<td>NEARSHORE</td>
<td>Extents seaward from the low water line beyond the breaker zone; it defines the area influenced by the nearshore currents.</td>
</tr>
<tr>
<td>OFFSHORE</td>
<td>Extents seaward from the nearshore zone.</td>
</tr>
<tr>
<td>SHORELINE</td>
<td>The line that marks the contact between land and sea. It migrates up and sown as the tide rises and falls.</td>
</tr>
<tr>
<td>COASTLINE</td>
<td>The coast’s seaward edge. The landward limit of the effect of the highest storm waves on the shore.</td>
</tr>
<tr>
<td>TIDAL MARSH</td>
<td>It is a type of wetland regularly inundated by the tidal action. It is located in the back part of the barrier Island.</td>
</tr>
<tr>
<td>SWAMP</td>
<td>It is a type of wetland characterized by low, generally saturated land covered intermittently or permanently with shallow bodies of water. It can be covered by either aquatic vegetation or vegetation that tolerates periodical inundation. The water of a swamp may be fresh water or salt water.</td>
</tr>
</tbody>
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**STOP 1. BRAZOS RIVER**

After watching the video with Dr. Wellner discussing the Brazos River, answer the following questions.

1. What type of river is the Brazos River?
2. On which side of the Brazos River do deposition of sediments occur?
3. Describe the water in the Brazos River and explain why it has a distinctive color.
4. When this video was recorded, was the Brazos River below or above flood stage?

5. Describe the suspended sediment load in the Brazos River?

6. On which side of the Brazos River does deposition of sediment occur?

EXERCISE 2.

1. Look at the picture of the trench dug into the river bar (Figure 3), describe the sedimentary structures present in the trench.

2. How are these sedimentary structures created?

3. In which part of the river could this structures form? Hint: use Figure 4.
EXERCISE 3

The purpose of this exercise is to locate the NOAA water level station in google maps and get water levels. Follow the steps below:

1. In the link below look for the LAT and Lon of the Brazos River near Rosharon station.

   LAT LON How far north of the equator is this water level gauge. Use your latitude and remember that 1° latitude is ~111 km.

2. Check water levels for the Brazos River near Rosharon station in the link below and report today’s water level:

   Date: Time: Water level (ft): Is it rising or falling?

3. How does the level of the river that you observe today compare with that when the video was recorded?

STOP 2 & 3. MODERN AND PALEO BRAZOS RIVER DELTA

1. What type of coastal deposit feature was discovered by Dr. Sisson in the current mouth of Brazos River? What is it called?

2. How has Hurricane Harvey affected the beach?
EXERCISE 4. THE FORMATION AND EROSION OF RIVER DELTAS: THE PALEO AND MODERN BRAZOS DELTA

a) Using the images below in Figures 5 and 6, describe the evolution of the old and the new Brazos River delta through time.

Figure 5. Time photos evolution Brazos river old and new deltas. Photos A and B from Rodriguez, A., et al., 2000. Photo C from Google Earth in 2018.
Stop 3 Paleo Brazos river delta

True or False:

   The waterway is tidal at stop 3.
   
   In the Gulf Coast, there is a very narrow continental shelf. So, the tidal forces are very large here.
   
   Particularly in the summers, the breezes are always onshore.
   
   The high and low tides occur always at 2:00 am and 11:00 pm, respectively.
   
   The sand flux is similar during summertime and wintertime.
   
   The tidal range is sometimes only about a foot and the tidal frequency is as regular as elsewhere

EXERCISE 5. TEXAS COAST GRAIN SIZES

Sediments from the Texas coast have been analyzed for grain size, using a laser particle analyzer, at the UH sedimentology lab. Using the grain size results in figure 13:

a) What is the mean the grain size value for the Paleo Brazos River Delta, is the sample well sorted?

b) What is the mean the grain size value for the Modern Brazos River Delta, is the sample well sorted?

c) What is the mean the grain size value for the Galveston State Park- Beach, is the sample well sorted?

d) Locate the samples in a map, what can you interpret from the different grain size result along the Texas coast.
STOP 4. GALVESTON STATE PARK

1. Describe the differences between the sediments observed between the beaches and the back bay?

2. Why is the marine vegetation that grows in the backbay is important in the CO₂ cycle and climate change?

3. What is the typical direction of sand movement caused by the currents in the beach?

4. Describe the difference in the color of the water at this stop with that at the Brazos River. Why is the water on the beach not blue?

5. How many miles the beach would have been 10,000 years ago in the location of Stop 4?
EXERCISE 6: UNDERSTANDING WAVE RIPPLES AND THE LONGSHORE DRIFT CURRENT

a) Using the picture below (Figure 8), answer the following questions:
   How do you think these ripples are being formed?

   ![Figure 8. Wave ripples at the Galveston State Park beach.](image)

b) The longshore drift is the movement of material along a coast by waves that approach at an angle to the shore but recede directly away from it. In what direction are the waves approaching the shore in Figure 7? What is the longshore drift direction in the Texas coast? Hint: Use what you learn about longshore drift currents at the stop 3.

   ![Figure 9. Same as figure 8 with direction of wind shown by arrow.](image)
STOP 5. GALVESTON SEAWALL

EXERCISE 7: HOW FAST IS THE BEACH BEING ERODED?

In this exercise you will quantify how fast is the beach being eroded. Using the time pictures below (Figure 10) calculate the beach retreat rate between different years at the seawall and the average retreat rate at the seawall. Note the road on the top of the 1954 aerial photo (marked with a red dot in each image). You can use this to estimate the distance to the beach in 1954 and 1974 and subsequent years. For example, measure the distance from the red dot to shoreline and use the scale bar on the photo. With this measurement, the beach is ~260 m from the red dot in 1954. You need to calculate the distance to the beach from the red dot at each time. Your measurements can be used to calculate either erosion or growth of the beach through time by simply dividing the difference in distance to the beach by the number of years between each image.
Figure 10. Galveston Seawall through time. Photos from Google Earth.

1. 1954-1974 = m/yr
2. 1974-1987 = m/yr
3. 1987-1995 = m/yr
4. 1995-2004 = m/yr
5. 2004-2015 = m/yr
6. Average beach retreat rate = m/yr

Describe the changes in the beach relative to the seawall through time.

EXERCISE 8: IKE DIKE
The Ike dike has been the focus of continued discussion (figure 11). Much of the recent discussion is about the entrance between the east end of Galveston Island that you saw at Stop 6.

Figure 11. Summary proposed features of the Ike dike.

The Ike Dike will be a coastal barrier project of about $26 billion, proposed by Dr. Bill Merrell of Texas A&M University at Galveston, that will protect the Galveston Bay in Texas. The project encompasses three different elements (figure 10): 1. Enhancement to the existing Galveston Seawall, 2. Two floodgates located in Bolivar roads and San Luis Pass, which would protect Galveston, the Bolivar
Peninsula, the Galveston Bay Area, and Houston. 3. Extended barrier across Galveston Island and the Bolivar Peninsula, that will be covered by manmade dunes.

News about the Ike Dike is often in the Houston Chronicle. Recently, some have raised concerns about its effect on Galveston Bay as well as about how the Ike Dike may not protect against all storms especially with climate change. How will this be paid for? Click here for a recent KHOU news report or here for a recent editorial in the Houston Chronicle.

Write a paragraph in which you explain your position on the Ike dike and how should it be paid for, be sure to use the geology concepts learn in class and in this Virtual field trip such as the information you got in Exercise 6, what changes do you think will happen to the beaches? Will all the sand that is accreting to the end of Galveston Island be deposited on the bay side of the new barrier or will it bypass the barrier and be deposited on the beaches? Do you think the proposed funding mechanism is appropriate?