Salt Creek Beach Park – Coastal Features and Processes

Dr. Mark Boryta - Mt. San Antonio College Earth Science Field Trip

---

Congratulations! You've chosen to embark on an adventure to an area that may appear rather commonplace on the surface, but is in reality a fascinating laboratory of geological and oceanographic processes and resulting landforms. The complex relationships among land, sea and air, coupled with the immensity of Plate Tectonic forces, have created a scene that at once depicts serenity and violence, safety and impending doom! Your job will be to:

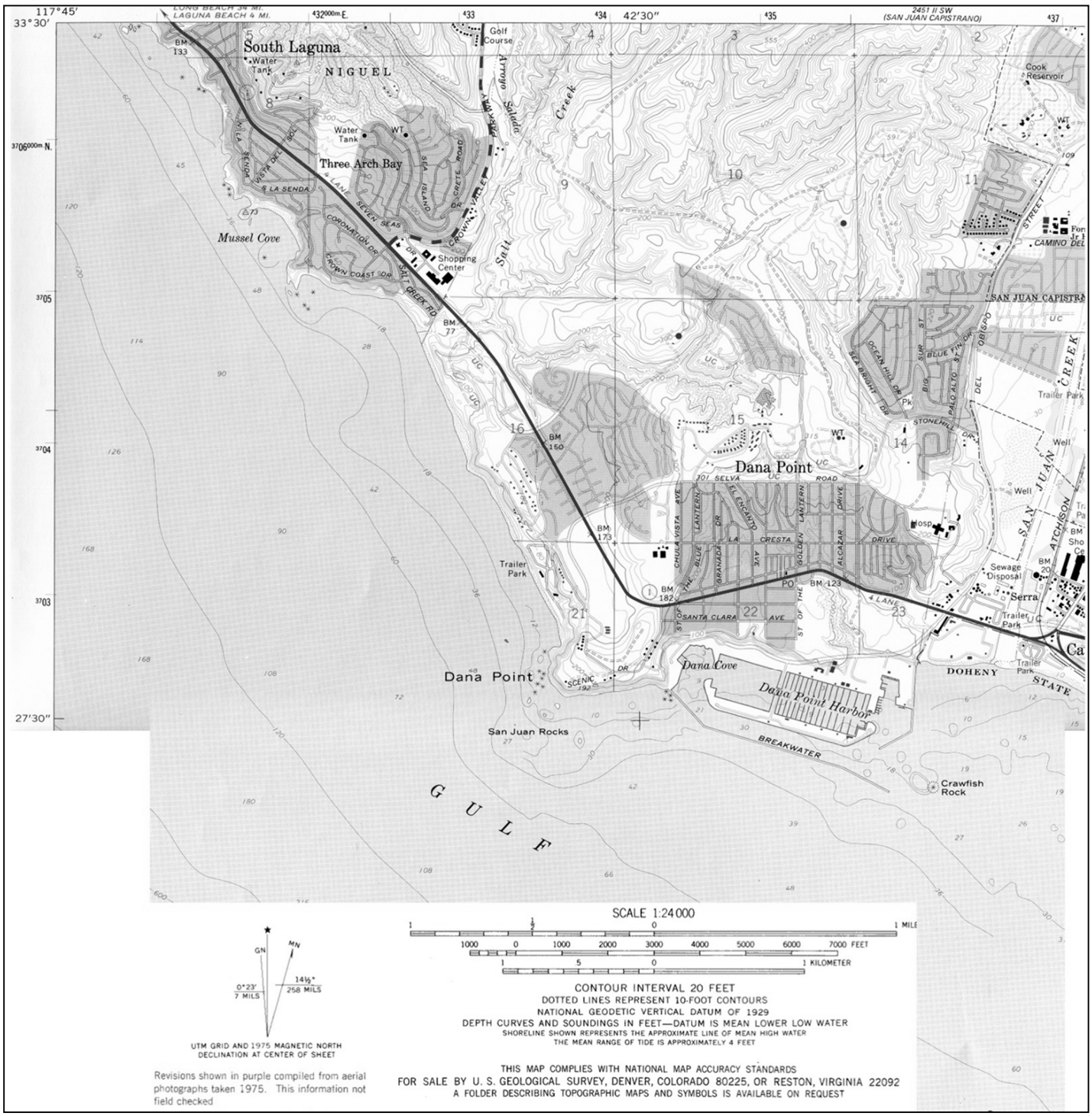
- discover evidence of these processes, recording your observations on these pages;
- assimilate the evidence into your understanding of the coastal environment; and
- **turn in YOUR OWN last page at the end of the trip**!

You will find it best to work in teams, but will **write your assignment page individually**; try to work *together* (everyone should contribute!) and *efficiently* - the more you get done, the more you'll understand! With this in mind, here are a few guidelines to give the day some structure:

1. PAY ATTENTION TO THE INSTRUCTOR. Who knows, you might get valuable information – like when is the bus leaving? Along this line of thinking, you should position yourself so that you can hear what is being discussed. The beach is a noisy place, and sound gets lost easily. There will be plenty of time to talk among your friends/groups during the trip.
2. It is far too easy to get distracted from the project; don't let this happen to you! Stay "on task!" The points you earn are based on your participation in/completion of the "official activities," not your mere physical presence.
3. Take responsibility. **Know what time it is**, and **where you should be at special times.** Get your class-related observations done before you pursue other interesting endeavors!
4. Conduct yourself according to standards appropriate to a Mt. SAC College student. Our "rules" from campus even apply on field trips. Show respect for those around you, DO NOT LITTER, do not make a mess on the bus, pick up after yourself, etc.

Okay, let's get down to the nitty, as well as the gritty! We have come quite a way to be at Salt Creek Beach Park. You can see a general map of our location in the following figure. To get down to the shore, walk to the southwest corner of the parking lot and down the walkway. Be sure you've got everything you need from the bus/car, including your keys!!! As you walk down to the beach, look out across the water and try to get a feel for the way the place is laid out (the orientation and shape of the landscape, etc.), the general direction of the waves, the variations in shape and width of the beach, and anything else geological or oceanographic that you can see. Relate these to the map printed on the next page. Can you find where we are on the map? Once you get down to the beach, you and your group do the following "activities;" remember, you might see questions cropping up on exams that are related to what you see and do today, so it's important that YOU PERSONALLY UNDERSTAND what the questions – and answers – are about! It is not necessary to do the activities in the order given; just make sure you get a chance to do them all.

1. You're sitting above one of the nicer beaches in Southern California, where beautiful people, light breezes, clean water and sand come together. Look down carefully at that beach and at the map on the next page, and write down ON THE VERY BACK PAGE OF THIS PACKET your thoughts – before any other observations – about the following three questions (1A-C):
   A. Where do you think that sand might have come from? If you come up with multiple sources, then what do you think might be their relative contributions? (For a silly example, perhaps you might think that 40% comes from the sky and 60% comes from nearby volcanic eruptions.)



B. What evidence do you think would prove or disprove your hypothesis?

C. What observations might you make that will allow you to evaluate the relative contributions from multiple sources?

2. Sit for 5 minutes (I know, that's tough!) and **watch the deep-water waves**. Look beyond the surf: which direction are most of them coming from? Use the fact that the beach trends mainly NNW-SSE, so you are looking roughly toward the WSW if you look straight out from the shore. Try to **draw what you see** (lines representing wave crests; **show refraction**) on the map above (try not to cover up any data on the map). Are there different sets of waves – waves that come from other directions? Try to

estimate the proportion of these (say, "1 in 5 comes from the north" or "10% come from the south.") What happens to the waves as they approach the beach - how far offshore do the waves break? Fill out the chart below with your answers to these questions:

Wind	Early in Day TIME: _____		Late in Day TIME: _____	
	Direction: _____	Speed: None Gentle Brisk Gusty	Direction: _____	Speed: None Gentle Brisk Gusty
Dominant Waves	Direction: _____	Height: _____	% of total: ____	Break First: NW/SE
Other Waves	Direction: _____	Height: _____	% of total: ____	Break First: NW/SE
Waves break how far offshore? _____				

3. As you walk **southward** down to the beach, look at the cliff on the side of the beach road, opposite the place where the lifeguard trucks enter the beach.

   A. What kind of rock is it made of? Does it look like there is an orientation to it – a layering perhaps? **Describe** the rock type(s); you could even pick up a piece, like a real geologist! You'll want it to compare with the sand along the beach and with rock types from the north end. Do you think this rock could be weathered to become the sand on the beach?

   B. Next, step back and **draw a sketch** (be sure to include a SCALE in your picture) that captures their orientation as best you can.

4. Next, try to figure out which way Longshore Current (the direction that sediment is being transported along the beach) USUALLY flows in this area. This is something to think about *throughout your travels along the beach* (don't just try to go about answering right now; instead, try to "multitask" – keep this in the back of your mind). There are several ways to evaluate this, and you should try to figure out which is the most reliable. The different observations you can use to show this may or may not give the same result. Observe as many different kinds of information as you can, including (but not limited to):

A. Which way are the waves breaking *right now*? You already answered this in the chart above: _____

B. There is a Groin (man-made pile of rocks sticking out into the water) at the lifeguard tower. Is there any evidence that sediment has been deposited on one side more than the other? Draw a picture that captures this evidence – again, don't forget the SCALE. Does this information conflict with your answer to 4A? If so, what does this mean?

C. Determine whether there are changes in sediment composition and/or texture ***along the length of the WHOLE beach*** – yes, from the groin at the south to the northern (naturally rocky) end. Try to note changes in color, grain size, sorting, and composition; what might such changes tell you about longshore currents? You should compare your thoughts/observations with your analysis of the rock types exposed in the respective cliffs (see Q. 3, 10).

5. *When you get to a naturally formed part of the beach* (somewhere in the middle – CHECK WITH YOUR INSTRUCTOR), try to draw a "beach profile" – a sketch that shows **how steep** the different parts of the beach are (NOT an Oblique or Map View) – from the surf to the vegetation. You might include a person for scale! Try to be careful. Draw your profile here (USE A PENCIL!):

6. In order to get a really good idea of how longshore current works, try to keep an eye on the waves and what they do as they come up the beach. Pick an average spot along the beach (no special circumstances, like big rocks, etc. that might interfere), and write answers to these questions:

   A. What is happening to the **energy** of the waves as they crash on the beach? Try to get as close to the water as you can to see this happening (without getting soaked – you have to get back in the car someday!). Is there one point - a particular phase of any wave - that involves a special **increase in its ability to pick up sediment**?

   B. Is the wave energy being used to accomplish anything, like, say, to erode, transport or deposit sediment? Describe **evidence** for that happening, and what you think is going on.

C. Can you notice any difference in the ability of **different** waves to move sediment – differences related to their **direction**, or to the **slope** of the beach face? Try to repeat these observations at another place that has a different slope and/or direction.

D. In the end, do you think there is net <u>deposition</u> or <u>erosion</u> of sand at this beach due to wave activity? ***What evidence can you cite?***

7. As you make your way toward the north end, you will cross a tiny drainage ditch; then you will come to a much larger stream. This is Salt Creek – a stream that actually drains many square miles of the land to the (north) east of the beach (see your map on page 2).

   A. **Draw a Map View** of the shape of the stream (as though from above) as it crosses the beach. If you draw very carefully, you may be able to see that changes have occurred by the time we return at the end of the day! Pay particular attention to what happens to the beach sand making up the banks of the stream as it curves – does it look like one side is more involved with erosion (wearing away) than another? We identify these different sides as "**cut bank**" and "**point bar**" – see if you can identify examples of these in the stream. Describe them, and note them on your sketch!

   B. Watch the formation and progression of antidunes. Which way does sediment actually move along the stream bed?

8. At the mouth of the stream, watch for a moment as the energy of the stream fights with the energy of the **waves**. What happens to the (both stream and ocean) water, and therefore the sediment that it carries?

Cross Salt Creek – try not to fall in! Proceed toward the boulder-strewn northern end.

9. As you walk northward, try to notice what kind of (non-human) organisms live in the sandy beach environment. What do they look like they're doing?

Organisms that use the **sandy** beach include

10. As you approach the north end of the beach you should notice that the sandy part suddenly gets narrower until you can find only rocks and a cliff. This is a part of the beach that is especially interesting to us (is that an order?)! *You should spend about a half hour to 45 minutes preparing your answers to this question and the next.* Once you've gotten into this part of the beach, look carefully at the cliffs; you should see some slanted layers of rock. These are layers of a poorly sorted sedimentary rock made up of large and small particles derived from the continents (lithogenous/terrigenous). This unit is formally called the San Onofre Breccia.

    A. Is it clear that this unit is sedimentary? After all, when particles get transported by water, they get rounded. Are the particles embedded in the cliff rounded and smooth, or are they angular? Compare the rocks on the beach with the rocks in the cliff; is there any difference in their shapes?

    B. Is there any difference in compositions of rocks in the cliff vs. rocks on the beach? What rock type(s) dominates overall? You can be general or specific. List as many rock types as you can find.

    C. Step as far back from the cliff as you SAFELY can (toward the water) so that you can draw a sketch of the cliff and the rocks on the beach. Choose a "block" of the cliff to draw that is about 20 ft wide, and that shows what you think is important geologically (hopefully, that will include the tilting of the rock strata, the sizes of the cliff and particles, and the relationship to the beach, at the very least.) Be sure to indicate the **SCALE** of your drawing somehow.

Scale:

    D. Do the materials that make up this cliff look like they could be ground up (abraded) to form the sand on the main beach? Explain what you think about this.

11. Proceed northward to the flat rocks exposed at sea level. This place is a great place for looking for organisms in the tidepools (pools remaining when the tide is out). This flat outcrop of rock, made up of the same material as the ("wave-cut") cliff, is known as a "wave-cut platform."

A. Draw a profile (cross-section – like you did for Q. 5), from the waves to the top of the cliff, in which you capture the nature of the materials and their features - where is the bedrock, where is the beach sand, what gradients are associated with each part, etc.

B. Explain why there is NOT a broad, sandy beach here!

Just north of the wave-cut platform, the beach gets wider again for a little bit; the sand here should look different to you from the sand at the main part of the beach. The headland is owned by someone who has hired a Security Guard to make sure no one trespasses. Try to answer the last few questions without causing the guard any trouble!

12. You have been walking on a gravelly sandstone that is well cemented; perhaps that's why it makes a headland! This is still part of the San Onofre Breccia.
    A. How do the compositions and orientations of this gravelly sandstone compare with the rock type you observed back at the cliff behind the groin (Q. 3 – do you still have a piece)?

    B. Note the "underwater sea stack" that affects incoming waves just seaward of the point. What happens to the **color of the water** after a wave crashes into it? What do you think this means for organisms that live here?

    C. Look down into the water. Is the ocean water carrying any sediment around Mussel Cove?

    D. Could the sediment on Salt Creek Beach be supplied from north of this point? Why or why not?

Name: _____

Salt Creek Beach Park – Coastal Features and Processes

Dr. Mark Boryta - Mt. San Antonio College Earth Science

Be sure that you have written your responses to Question #1A-C on the back of this page first! Then, check that you have an answer that you are comfortable with to Question #4C. Then answer the following BY YOURSELF – DO NOT COPY SOMEONE ELSE; NO GROUP PAPERS.

After you've looked at all the different types of evidence, where do you think most of the sand that makes up this beach comes from - WHAT IS THE SOURCE OF SEDIMENT FOR SALT CREEK BEACH? Sum up what EACH line of evidence tells you; which is/are your most valuable observation/s, and why? Why might you give more weight to some of your observations than others? Your return walk is a chance to work this out! Write up your thoughts on this matter, hand in your work BEFORE YOU LEAVE, and then head home.