PORTUGUESE BEND - FIELD TRIP

1. Park at the very end of Crenshaw Blvd's extension past Del Cerro Park. Meet at 8:30AM but plan to haveparents (enough cars to take everyone back to the start point!) pick us up at the east end of the landslide on Palos Verdes Drive South. Equipment: hiking shoes, water, hat, hand pick, compass Pass out the handouts for the field trip.

Originally Crenshaw Blvd was (like Hawthorne Blvd) to wind down the south side of the peninsula to PV Drive South. At this time(1956) there occured a reactivation of this ancient landslide area which stopped the construction. The road provides us with a trail and the roadcuts have revealed some of the stratigraphy. This landslide continues today and has lasted longer than any in California. There were 160 homes in the Portuguese Bend area at that time and now only 30 are left. Some are on jacks for leveling purposes and the maintenance cost is significant. Los Angeles County was sued and paid for damages. Since then California law has required geological reports before land is to be developed.

Discuss the time line or **geological stratigraphic column** for Palos Verdes/San Pedro. The Monterey Shale of the Miocene epoch is here composed (1) Altamira shale member, (2) Valmonte diatomite member, and (3) Malaga mudstone member. Diatoms are tiny marine plants. 100,000 diatoms could fit on a fingernail. When they die, their silica shells or skeletons settle at the bottom of the ocean. There were two diatomite mines on the peninsula. One was between Crenshaw Blvd and Rolling Hills Road where the Botanical Gardens are. Such siliceous deposits are altered to become clay (bentonite).

Look at the map of the **bedrock distribution of the lithofacies** of Palos Verdes Peninsula Notice the intrusive basalts which are hard and "hold up" the rest of the rocks. On your drive back past Point Vicente, you can see the orange-colored basalt in the road cuts and along the shoreline you will see the more easily recognizable black basalt.

Turn to the figure of the actual **stratigraphic section of the tuffaceous lithofacies of the Altamira shale**. Siliceous rocks (sand, diatomite and chert) are represented as well as the very hard dolomite and basalt. Dolomite is creamish colored and because of its hardness, it is often the large rocks you find in Palos Verdes. (In fact, you're sitting on one, Jared!) The dolomite strata are useful in determining what portion of the section we are looking at when staring at a roadcut.

2. Begin the walk and stop along the road to look at the view.

Geomorphology is the study of landforms or features and their relationships to underlying structures and also the geologic history of the region. (1) We are at a height of 1400ft and the 1st wave-cut terrace is about 130ft above sea level. This is a very steep drop over a very short distance and is a "big" geologic clue. (2) The narrow canyon is v-shaped and hence "young". (3) The dolomite beds look flat but actually have a "dip" angle.

3. Stop at the 2nd telephone pole, then the 6th telephone pole, then along a narrow parallel path.

Break off some Valmonte shale. Notice the very thin layers called laminations. Diagenesis includes all the changes undergone by a sediment after its intitial deposition, exclusive of weathering and metamorphism. You may be able to find nodules of phosphate (fairly common in miocene rocks). Phosphates are used for fertilizer. We're still above the stratigraphic diagram. Further down the road, stop and look at the stratigraphy in the tall road cut. The two dolomite strata can be found on the stratigraphic column in your handout. The red is actually the same material as the valmonte shale we were just looking at. Silica is often recrystalized and in this case we're looking at chert. Try finding some in the road you're standing on! This chert or porcelanite was used for arrowheads and was traded by the Indians. Some of this chert has even ended up in Arizona.

Stratigraphy is the science of rock strata. (1) Notice the thick white areas. Why? (Compaction can be a factor.) (2) The bed attitude which dips toward the ocean is an important piece of information. Here it comes out of the hill. What we can see by taking the narrow parallel path is a sideways valley which occupies a syncline. The syncline funnels water to one of the largest springs on the peninsula where that narrow canyon cut into the syncline. (3) The various folds control the landscape. (4) Why are the beds slumped? There were submarine slumps and downhill slides often associated with basalts. The beds were still soft because they were bent and not broken.

4. Continue past a pressure station which provides the water for the Portuguese Bend homes.

Stop to look eastward and notice the top of the Pleistocene landslide. Below the first flat area is a second flat area which slid down. Besides these features are the 13 or 14 marine terraces. The peninsula continues to rise at about 1 or 2mm/yr. The top terrance is about 900,000 years old and the lowest terrace is about 120,000 years old.

Continuing down the road we can stop to look at some fancy stonework. Why? Notice the sandbagging. It is there to control runoff water. The plan is to keep the water out of slide fractures. The red pipes that we see are some of about 150 wells which were drilled to obtain geologic information of the area. Some are used as dewatering well as well (but not this one). (1) Absorbed water changes the internal friction of the rock or bentonite clay. (2) Free water creates a buoyancy effect and (3) lubricates the slide. Further down the road a wooden structure will cover a red-pipe well. The white pvc pipe will send the water to the ocean.

5. Take the path off the road for just a bit to overlook Kelvin Canyon.

The vegetation is a real thicket and there is the location of that major spring that discussed earlier. 25 gal/min or 30,000 gal/day comes out of that one spring. It comes from (1) landscape water (2) septic tanks and (3) rainwater. A study is currently being done to determine the laws limiting septic water are being violated. Converting from septic tanks will be an expensive change. Malaga Cove's bank found seepage into there vault. Some homes use 1,000 gal/day especially with auto-sprinkling systems.

6. Take the “steep and slippery” road down past some horse trails. A stop to look at the landslide area. Another stop by a broken piece of the metal drainage pipe.

Exotic plants are simply non-native. They include fennel, acacia, pepper trees, ucca, and eucalyptus trees. They were brought by man, earlier by Indians. The oak trees were cut down long ago for firewood and cattle ate up any acorns. So what we see today in the 20th century is mostly “exotic”.

What we can see to the east are some secondary slumps which are typical for the headward movement of a landslide. Left is the Portuguese Bend Canyon. We can also see the toe of a secondary slump. Walking thru that area, one would find numerous small fractures 1ft wide by 3ft deep.

To stop or slow the landslide, “pins” were put into the toe. This was 1977 and it did not work. Some of the sheared pins can still be found(?). RHE at first decided to forget the area but found that maintenance was costing the city $200,000/yr. It then decided on trying mitigating efforts with the thought to possible future development of the land for say a golf course. Dewatering is important. However, after 40 years of movement, the block has been broken-up and the melange or mix has low permeability and the 3,000 gal/day of pumping is not worth the cost. Most of these wells have been stopped. In the late 1980’s the city has moved land to shift the weight from the top of the slide to the toe area. The net effect is to slow the rate of sliding as shown in the **displacement of Portuguese Bend landslide**. The J2 survey station (look for the triangle on the map) slowed it’s movement from 23 ft/yr to 10 ft/year.

We finish up our walk at the eastern side of the slide, The situation is complex. The western side doesn’t move very much. 19 wells in Abalone Cove pump 350,000 gal/day. It varies from 200,000 to 400,000 gal/day depending on the time of the year. It must be noted that there is around a 6 month delay in the effect of heavy rains. The percolation is very slow. The east part of the slide is much faster which results in a slight rotation. The road is pushed out on the east side of the slide which cuts across the road. The Portuguese Canyon seen in pre-slide pictures has been filled in. The area is now a depression. The land once was level from the east cliff to the homes across the trough we’re standing in. In the 1960’s there was pond water and a Lake Ishibashi which was named after a Japanese-American who farmed in the area. The slide and man’s efforts to fill the area have changed the landscape. December 1997 finds a big ditch to the depth of the slide plane (here, about 10 ft) which is manmade. The plan is to fill the ditch with dry concrete which will react with the bentonite. The chemical reaction or ion exchange of calcium for sodium will hopefully stiffen the clay.