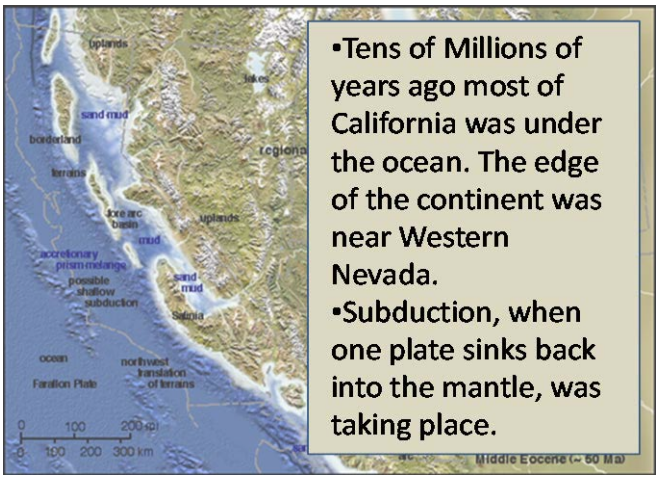
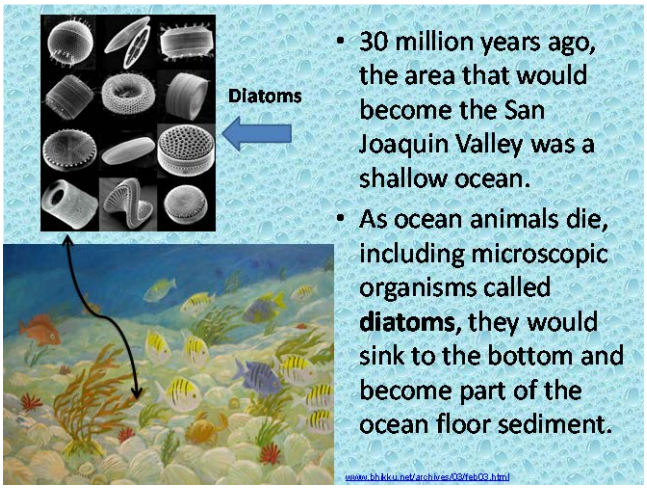
Teacher Notes-Slide1: **If you have time allow students to volunteer answers.**

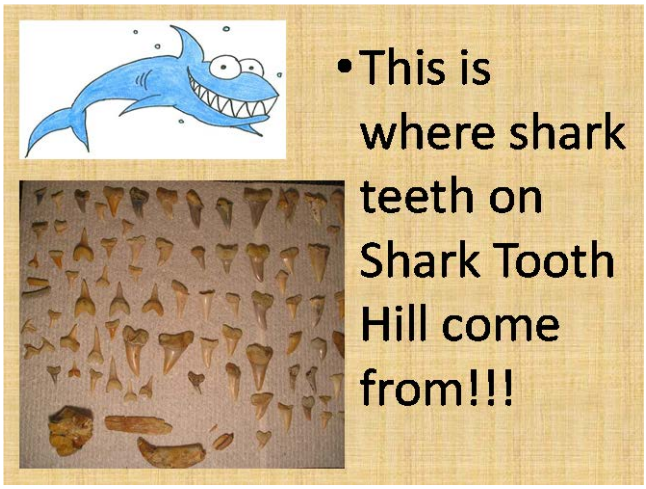


Teacher Notes-Slide 2: **Answers QUESTION #1 and #2. Pause for two to three minutes on this slide so that students have time to answer these questions. Also you may want to point out the white outline of CA current coastline, which is out in the ocean on this slide.**

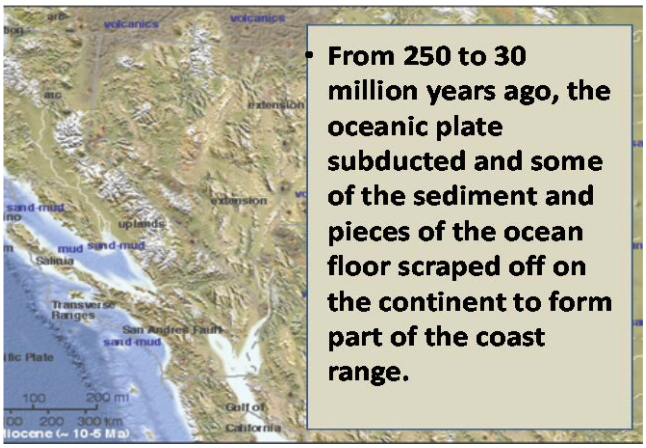
Teacher Notes-Slide 3: **This is a composite or strato-volcano. Composite volcanoes still exist in the Pacific north-west. Due to the subduction of the Juan de Fuca plate below the North American plate, examples of some of the composite volcanoes along the Cascade Range that the subduction creates are Mt. Saint Helens, Mt. Rainer, Mt. Hood, and California's Mt. Shasta.**



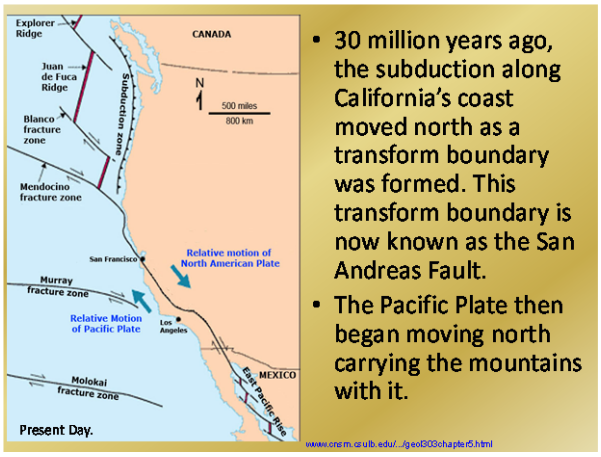
Teacher Notes-Slide 4: Answers QUESTION #3. Direct students to write "ocean" in the first blank and "diatoms" in the second.



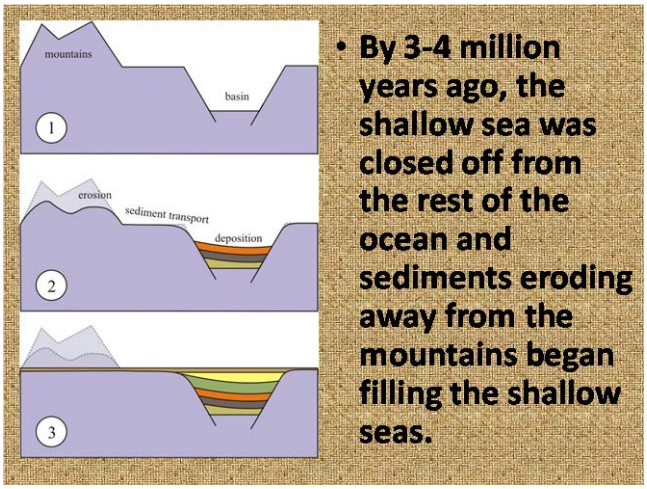
Teacher Notes-Slide 5: Shark Tooth Hill is located across the river from Hart Park off of Round Mountain Road. Unfortunately, it is on private property and is a known location of Valley Fever spores.



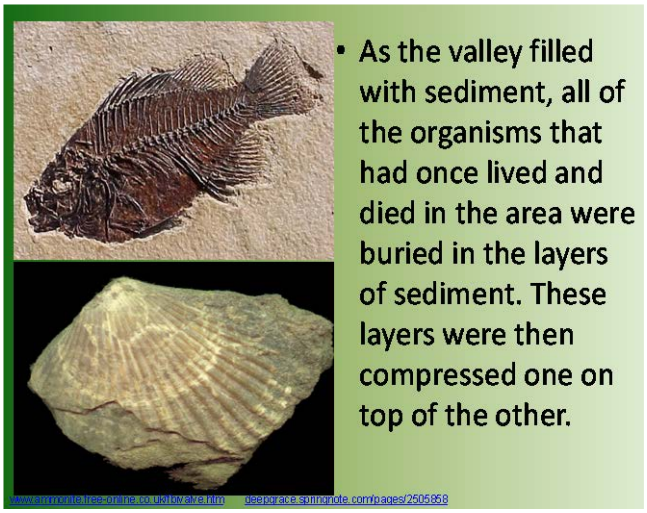
Teacher Notes-Slide 6: The process of sediments and seafloor scraping off onto the continent is called accretion. This land is referred to as accreted terrain and exists all along the West Coast. Point out to students that the inland sea in this slide is the future location of the San Joaquin Valley and the mountains to the East of it are the Sierra Nevada



Teacher Notes-Slide 7: Answers QUESTION #4. Subduction still takes place along Northern California, Oregon, and Washington, creating the volcanically active Cascade Range.



Teacher Notes-Slide 8: Answers QUESTION #5. The sea was closed off because the Pacific Plate was moving North carrying land. This land blocked the opening to the ocean and the valley has been filling with sediment ever since.

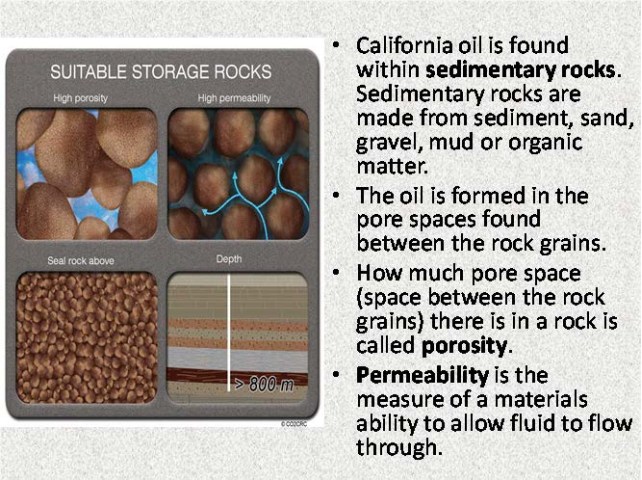


Teacher Notes-Slide 9: As sediment accumulates, it creates the pressure needed to turn the organic matter into oil.

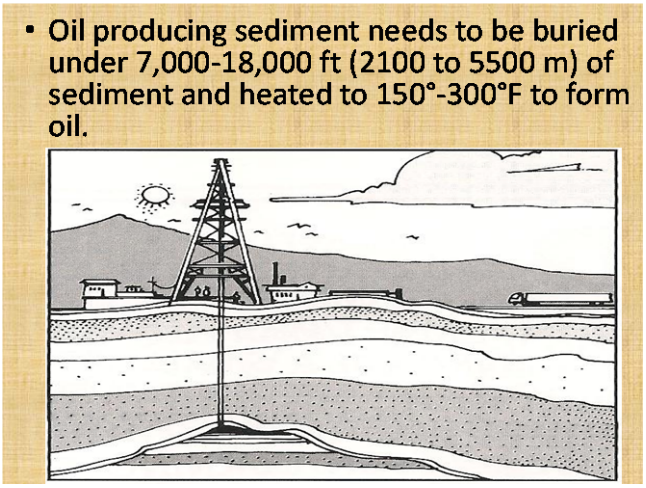
Teacher Notes-Slide 10: As sediment layers stacked on top of the marine plants and animals, the heat and pressure from the weight of the sediment compressed the organic matter into oil.

Teacher Notes-Slide 11: Answers QUESTION #6. Dinosaurs became extinct 65 million years ago. The process that formed the San Joaquin Valley oil began about 30 million years ago.

Teacher Notes-Slide 12: You met let students guess or share locations they know have oil wells on them.

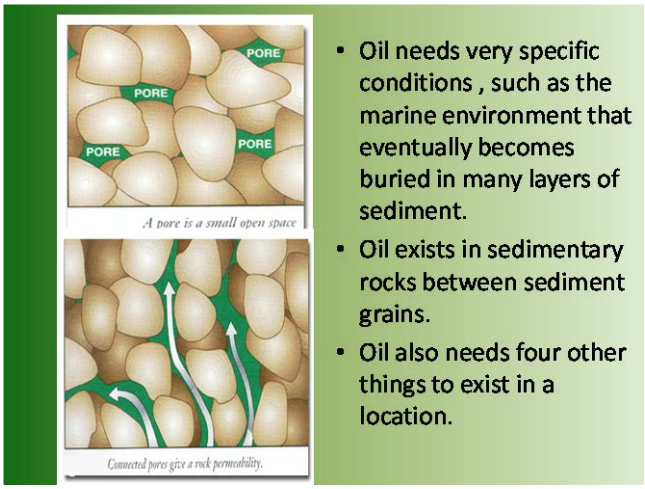


Teacher Notes-Slide 13: The first paragraph in this slide answers QUESTION #7. Students will need a minute for this because they will have to write down a longer answer. QUESTION #8 is in the last paragraph. You may need to help students with the definition for porosity.



Teacher Notes-Slide 14: The Empire State Building is 1250 ft tall, so oil needs to be buried over five times deeper than the Empire State Building is tall or is deeper than Mt. Whitney is tall.

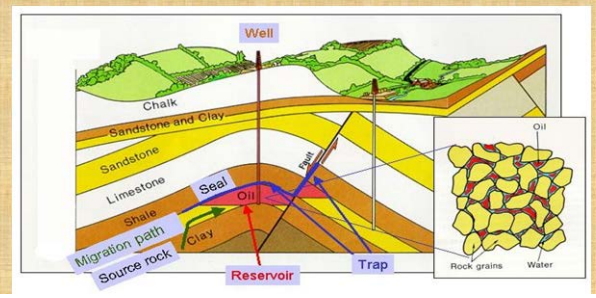
Teacher Notes-Slide 15: Let students suggest some reasons if you have time. Hopefully they will mention the shallow seas that became buried in sediment did not exist everywhere.



- Oil needs very specific conditions , such as the marine environment that eventually becomes buried in many layers of sediment.
- Oil exists in sedimentary rocks between sediment grains.
- Oil also needs four other things to exist in a location.

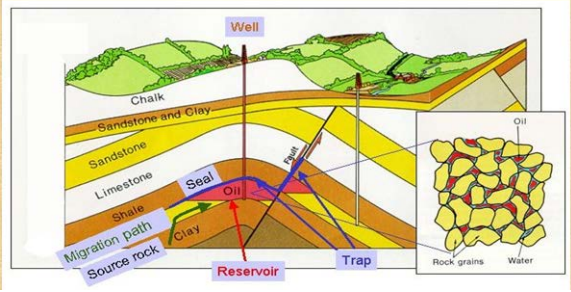
Teacher Notes-Slide 16: Use this slide to review the vocabulary for porosity and permeability. You can also compare the low permeability of the top picture (because the pore are not connected) to the high permeability (connected pores) of the bottom picture.

1. **reservoir rock**: any porous rock that holds oil or gas.
2. **source rock**: the geologic formation in which oil or gas originates.



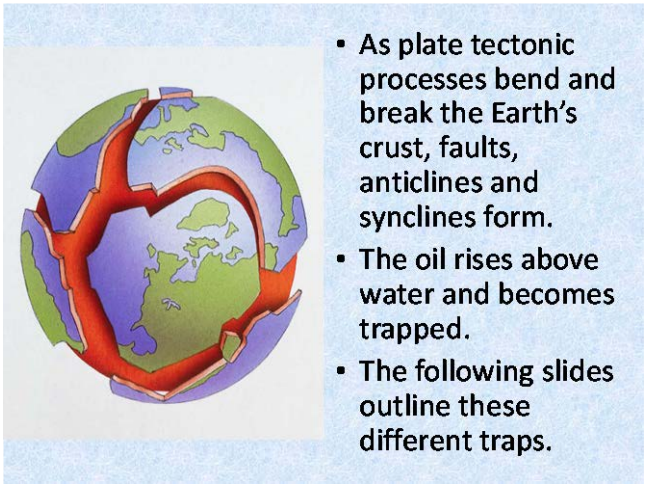
Teacher Notes-Slide 17: This answers QUESTION #10A and 10B. Reservoir Rock: most commonly a sedimentary rock, usually sandstone or conglomerate. Source Rock: The rock that carbon based life is initially deposited in and buried for oil to form. Because oil is less dense than water, it moves out of a source rock into a reservoir rocks above until it becomes trapped. Point out Reservoir rock and source rock on diagram.

3. **seal or cap**: a comparatively **impermeable** rock immediately overlying a reservoir. Impermeable means oil and water cannot pass through.
4. **trap**: a geologic feature that prevents oil or gas from escaping that location.

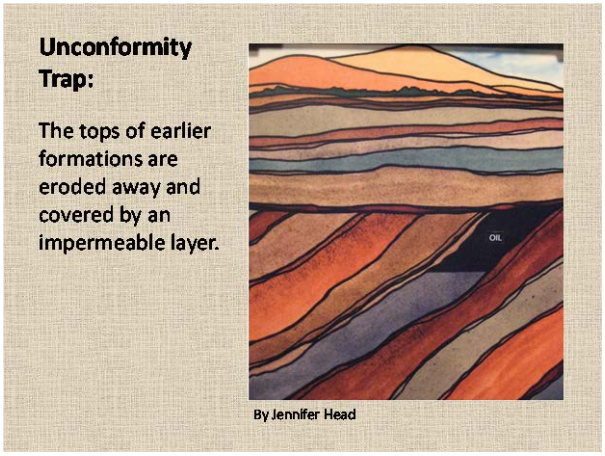


Teacher Notes-Slide 18: This slide answers QUESTION #10C and 10D. Give students a few minutes with this slide. You can also point out to students where the seal is and point out the fault trap (this trap will be discussed in a later slide).

Teacher Notes-Slide 19: **Review with students that they just wrote the definition of a trap.**



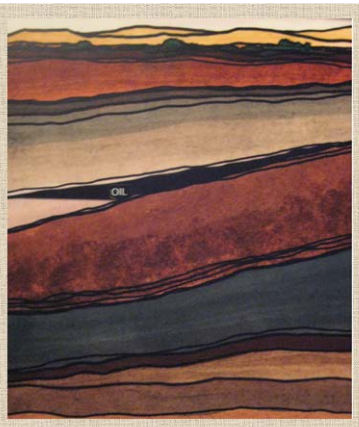
Teacher Notes-Slide 20: **(Anticline and Syncline are defined two slides ahead.) Most oil is less dense than water so it will rise above any water in the reservoir rock.**



Teacher Notes-Slide 21: **Formation is a rock structure. In this case, sedimentary rock layers of different ages. The next five slides describe each the oil traps that answer QUESTION #11. Leave these slides up long enough for students to describe each trap and draw the oil on their pictures. This slide answers QUESTION #11D.**

Pinch out Trap:

A layer of permeable sediment is pinched or squeezed between the layers above and below it.



By Jennifer Head

Teacher Notes-Slide 22: Strata is a sedimentary rock layer. This answers QUESTION #11C.

Anticline Trap:

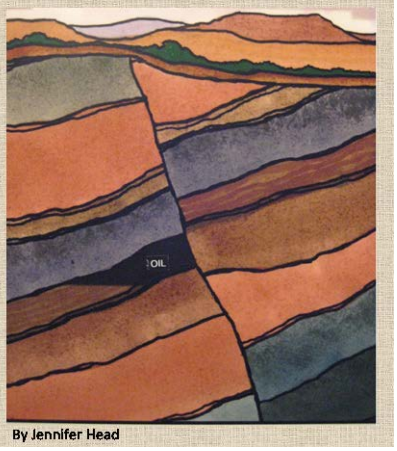
Layers of rock are squeezed creating an arch shape where oil gets trapped.

By Jennifer Head

Teacher Notes-Slide 23: Anticlines and Synclines usually exist together. They are created by the compression of Earth's crust. This answers QUESTION #11A.

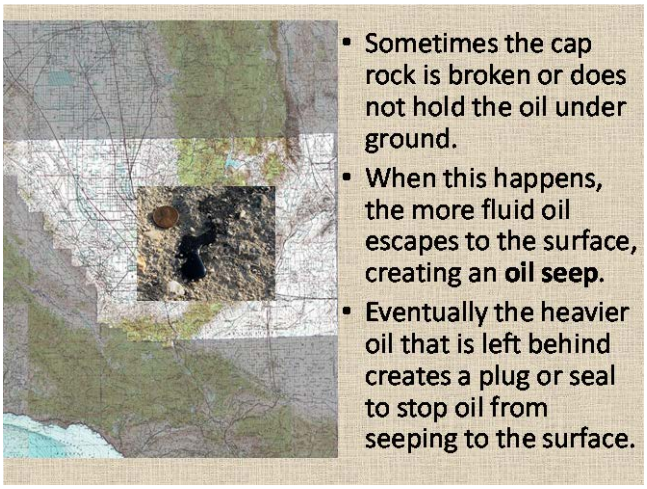
Fault Trap:

When a fault moves rock layers, a reservoir rock can be lined up with an impermeable rock layer.



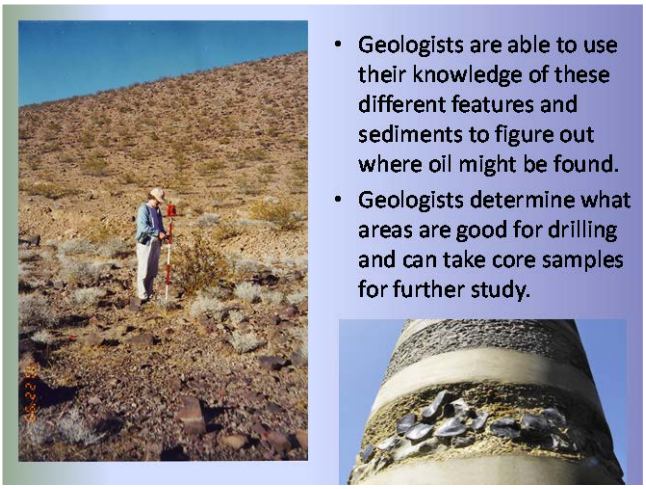
By Jennifer Head

Teacher Notes-Slide 24: A fault trap is created when the reservoir rock becomes lined up with an impermeable rock layer so that oil can no longer flow through. The fault plane can also act as an impermeable layer. This answers QUESTION #11B.

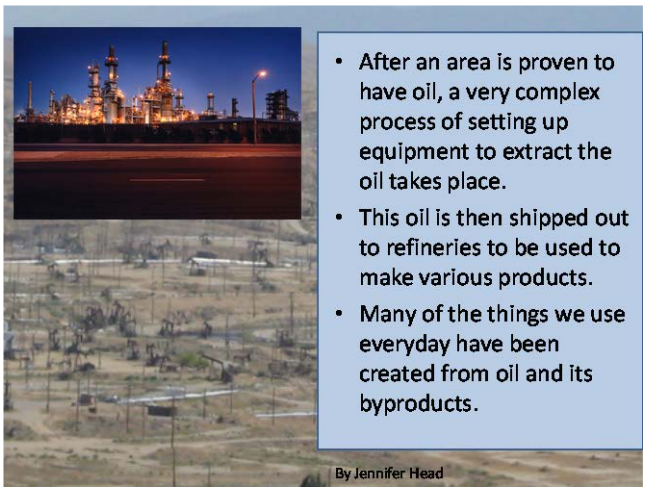


Teacher Notes-Slide 25: Oil seeps happen frequently in Kern County. Seeps can be seen near Taft and along Highway 58 near McKittrick. They can also be seen near Maricopa near Highway 166 and 33. This slide answers QUESTION #12.

Teacher Notes-Slide 26: You may ask the students why there is such a big oil industry in Kern County.

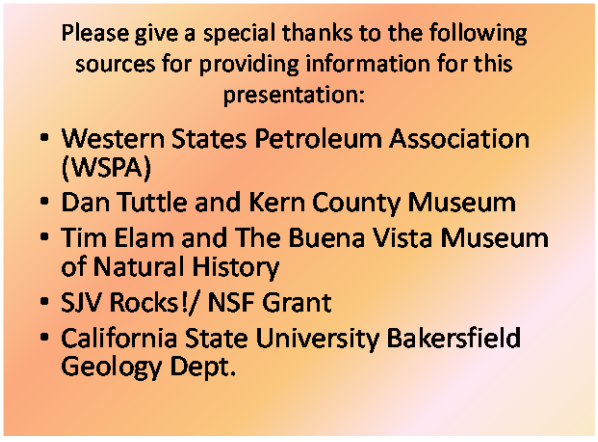


Teacher Notes-Slide 27: The features that Geologists study are the oil traps. Geologists use methods of "looking underground" using sound waves and other devices to locate these traps. There are many jobs in the field of geology in Kern County. California State University Bakersfield has an excellent program to train future geologists.



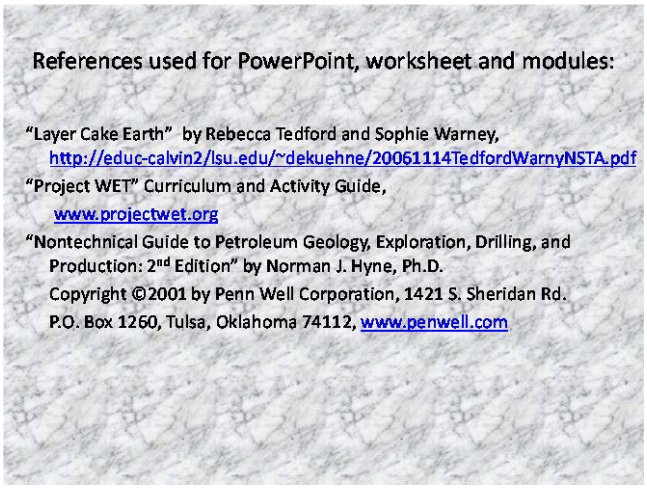
Teacher Notes-Slide 28: Pumps are frequently needed to bring oil to the surface. These pumps can extract anywhere from 1 to 150 barrels a day in Kern County. Oil is then shipped to a refinery to be processed into products we use every day. In some areas of the world, free flowing oil wells use a series of pipes and valves called a "Christmas Tree" (instead of a pump) to control the flow of oil.

Teacher Notes-Slide 29: This slide answers QUESTION #13. Students need to pick at least four of these items that they use every day. The items will pop up on the screen one at a time, so you may read them off as they come up or let the students read for themselves.



Teacher Notes-Slide 31: This page is for credits.

Teacher Notes-Slide 32: This slide contains websites where you can get further information.



Teacher Notes-Slide 33: This slide contains references for both the PowerPoint and the activities included in the module.