

TOPOGRAPHIC AND GEOLOGIC MAPS - GRADE 6

OBJECTIVES:

1. Compare a local topographic and geologic map.
2. Outline the Hayward Fault in Fremont.



VOCABULARY:

Concentric – circles and spheres of different sizes with the same middle point.

Contour lines - equal lines of elevation.

Ecosystem - biological community together with its environment, functioning as a unit.

Faults - fracture that can be traced by topographic and geological features, a break.

Formation - rocks that have been deposited in a similar environment at about the same time.

Geologic map - shows geologic features and rock types.

Sag Pond - ponds that are created by movement along a fault.

Sediments - small particles of rocks.

Topographic map - shows relief on land.

PROCEDURE:

Activity 1: Learning to interpret a topographic and geologic map.

Materials: Topographic map of Tyson Lagoon area; *Maps* slideshow

1. Use slide 1-2 of the *Maps* slideshow to help explain topographic and geologic maps and how to interpret them.
2. Pass out maps and have students answer the following questions from page 4 of their workbooks:
 1. Draw contour lines that show steepness.
 2. Draw contours that show a gentle incline.
 3. What is the symbol for railroad tracks?
 4. What school can be seen on the topographic map?
 5. How many benchmarks can you locate?
 6. Tyson Lagoon is a sag pond created by movement along the Hayward Fault. Find Tyson Lagoon and move your finger toward Lake Elizabeth. You have just traced a segment of the Hayward Fault. In Fremont you can see many sag ponds. They are a clue that there may be a fault. Does the Hayward Fault go through Fremont?
 7. Which map is more detailed?
 8. Where do you think you would be able to see rocks exposed? (Hint: what is a

canyon?)

Topographic maps show a three dimensional world in two dimensions by using **contour lines**. Many people have trouble reading these maps, because they have mountains and valleys are represented with **concentric** circles and lines. Many hikers use topographic maps, especially in areas where there are no roads with signs. Geologists depend on topographic maps to record the types of rocks. Engineers use topographic maps when they are planning roads, buildings, or other human-made structures. Imagine designing a city without considering where hills and valleys are located!

A geologic map is a map of the different types of rocks that are on the surface of the Earth. By mapping different rock types, geologists can determine the relationships between different rock formations which can then be used to find mineral resources, oil, and gravel deposits.

Earthquake zones or faults can also be identified on geologic maps based on rock formations. Earthquakes are caused by the sudden movement and fracturing of rock masses along pre-existing faults. A fault is a broken surface within Earth's crust.

Tyson Lagoon has been a site of fresh water for at least the last 3,700 years. This sag pond outlines the trace of the Hayward fault zone in this area. Looking at brittle deformation and liquefaction features in trenches just north of this area, Williams (1993) concluded there may have been 6-8 large earthquakes during the last 2,000 years. Lienkaemper, et al, with new data concluded that since late 1300's there were probably four large earthquakes (of magnitude 6.8-7.0) In trenches in the South Pond they found evidence of the 1868 earthquake. The earthquake destroyed most of the Mission Adobe structure and devastated the homes of many of the residents. Using detailed Stratigraphy and carbon dating they arrived at dates of 1730, 1630, and 1470 (± 90 years) for the other earthquake occurrences.

Detailed trenching in the south pond of Tyson Lagoon by the U.S. Geological Survey has identified other earthquakes that occurred in the past. They use data derived from trench logs, radiocarbon, pollen, and detailed sedimentological data. The trenching has exposed typical pond sediments, including well-bedded deposits of silty clay, interbedded with organic layers including shell hashes, and slightly coarser, less organic silts to sandy silts. The composition and structure of the deposits indicate a rapidly subsiding, shallow aquatic environment that was subject to seasonal drying. Evidence of creeping along the fault has been calculated with an average slip rate of 9 ± 2 mm/yr .

Activity 2: Identifying rock formations near the Hayward Fault.

Materials: Geologic map of Hayward Fault; geologic formation rock kit

1. Divide the class into groups of three or four students and pass out a geologic rock formation kit to each group.
2. Have them study the rocks closely and describe them on page 3 of their

- workbooks. Locate them on the geologic map to find their symbol.
3. What do these rocks tell us about the East Bay in the Fremont area. (use the slideshow to show the rocks in the field and how geologist would study)

Materials Provided

8 Geologic formation rock kits
Topographic map of Tule Pond at Tyson Lagoon area
Geologic map of Hayward Fault area