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VANDERBILT STUDENT VOLUNTEERS FOR SCIENCE
http://studentorgs.vanderbilt.edu/vsvs

CSI Nashville

Introduction
The Nashville Police Department recently received a package without a return address that contained a human mandible. The mandible was immediately handed over to forensic scientists to determine the owner of the bone and where the rest of the skeleton lies.

Forensic scientists first determined whose mandible it was. They matched the dental signature to a woman missing since last year. Currently, the forensic team is trying to determine the location of the remaining skeleton and have narrowed the search down to five potential areas. The sites include the Grand Bahama Island (Bahamas), Tralee Bay (Ireland), Sandestin (Florida), Coronado Beach (San Diego, CA), and Lake Michigan (Chicago, IL). Now it is your responsibility as a geologist to analyze the sediment from each site and compare your findings to the sediment retrieved from the nerve socket in the mandible.

Your Job
Analyze the mandible sediment and decide where you would go to look for the remaining skeleton of the missing woman.

Materials List
- 15 Illuminated microscopes (30X) with (8X) magnifier inside microscope
- 16 8 sets of jars of sand (5 per location)
- 8 Magnets with sleeves
- 15 bags containing:
  - 1 laminated sand mount (evidence from mandible)
  - 8 laminated sets of 5 different sand mounts (from the 5 locations)
  - 2 Grain comparators

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Background

1. Sediment: a collection of fragments (commonly quartz, chert, feldspar, magnetite, calcite, and organic bits) transported by a force and deposited as solid particles in loose layers on the earth's surface on land or at the bottom of a body of water

2. Where is sediment found?—rivers, floodplains, natural levees, lakes, seas, oceans, beaches, continental shelf, deserts (75% of land area covered by sediment)

3. Size of sediment: smaller than a clay fragment (<1/256 mm) to larger than a boulder (> 256 mm)

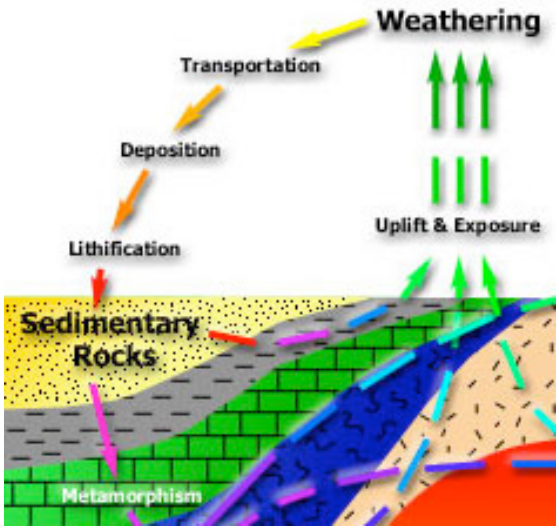
4. Sediment formation: sediment forms by the process of erosion which is the force that can break down any rock at the earth's surface to form sediment

5. Examples of erosional forces: water (rain, rivers, waves), wind, ice (glaciers), gravity (landslides), biota (plant roots, burrowing animals)

6. Sedimentary rock cycle:
   Any rock (**sedimentary, igneous, metamorphic**) exposed at the Earth's surface can become a sedimentary rock. The forces of erosion combine to break down or dissolve (**weather**), and carry away (**transport**) rocks exposed at the surface. These particles eventually come to rest (**deposited**) and become hard rock (**lithified**).

   Sedimentary rocks are important because they can contain fossils that tell us about the history of animals, plants or even climate.

   Society depends on sedimentary rocks because they may contain water for drinking or oil and gas to run our cars and heat our homes.



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Procedure

1. Describe the five samples of sediment. There is a jar and a laminated sand mount for each sample. Be sure to use your microscopes and grain comparators; they will be quite helpful. Record your observations on the sediment analysis chart using the following guidelines:
    a. Color: Use the sand mount to identify colors of individual sand grains. Look at the jars of sand to determine the overall sand color.
    b. Shape: Look at the shape of the grains in the sand mount and determine if they are more rounded (smooth) or angular (sharp). Use the grain comparator as a guide.
    c. Sorting: Look at the grains in the sand mount and determine if the grains are generally the same size or different sizes. Use the grain comparator as a guide.
    d. Grain size: Determine if the sand is coarse, medium, or fine in the sand mount. Use the grain comparator as a guide.
    e. Magnetite: Describe the amount, shape, and size of magnetic material called magnetite within the jar of sediment. Be sure to put the magnet in the sleeve for easy removal of magnetite from the magnet.
2. Describe the sediment from the mandible and record your observations on the sediment analysis chart just as you have done with the previous five samples.
3. Once your sediment analysis chart is complete, compare your descriptions of the mandible sediment to the five samples.
4. Decide which sample matches the mandible sediment the best.
5. Where would you go to look for the rest of the skeleton? Write a summary of your findings including where you would go to look for the remaining bones and why.

Explanation:

1. How did the microscope help you in describing the sediment?
   When students used microscopes, they can see details that would be missed with the naked eye.

2. Is sediment homogeneous?
   No, there are a variety of sizes, shapes, colors, and compositions based on where it is found.

3. Which sample does the sediment from the mandible match? Why?
   Sample 4, same sizes, shapes, colors, and compositions.

4. Where are you going to send your search team to look for the remaining skeleton?
   Coronado Beach, San Diego, CA

Discussion:

1. Locate on a map where each of the sediment samples was collected. Consider factors that affect the characteristics of the sediment.
   Inland/coastal, near/far from mountains, dry/wet environment, hot/cold climate, etc.

Lesson by Nichole Knepprath, GTF, 2005-2006, Vanderbilt University
Modified from Jack Deibert, Austin Peay State University

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CSI Nashville Instruction sheet

Introduction

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Now it is your responsibility as a geologist to analyze the sediment from each site and compare your findings to the sediment retrieved from the nerve socket in the mandible.
Analyze the mandible sediment and decide where you would go to look for the remaining skeleton of the missing woman.

Procedure

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Record your observations on the sediment analysis chart using the following guidelines:
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Once your sediment analysis chart is complete, compare your descriptions of the mandible sediment to the five samples.

3. Decide which sample matches the mandible sediment the best.
Where would you go to look for the rest of the skeleton? Write a summary of your findings including where you would go to look for the remaining bones and why.

Explanation:

5. How did the microscope help you in describing the sediment?
6. Is sediment homogeneous?
7. Which sample does the sediment from the mandible match? Why?
8. Where are you going to send your search team to look for the remaining skeleton?

Discussion:

2. Locate on a map where each of the sediment samples was collected. Consider factors that affect the characteristics of the sediment.