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GSI: Geo Scene Investigation! Pre-visit Lesson: Topographic and Geologic Maps (Grade 7)

Discover Mojave: Forever Earth

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GRADE 7

GSI

Geo Scene Investigation!

PRE-VISIT LESSON

Topographic and Geologic Maps

GSI

Geo Scene Investigation!

PRE-VISIT OVERVIEW

Geologists are scientists who study the structure and history of the Earth and its processes. Like detectives, geologists work to unravel the mysteries of the landscapes we see today using clues left behind by the geologic events that formed them. Through Forever Earth, students can get close to fascinating geological features and landforms to better understand the geologic processes that have shaped the Mojave Desert.

GSI: Geo Scene Investigation! introduces students to the differences between observations and interpretations and to some of the fundamental principles of geology. Students identify specific geologic processes and landforms in the landscape surrounding them at Lake Mead National Recreation Area (Lake Mead NRA) by solving mysteries with a set of geology-related clues.

Two pre-visit activities have been designed to prepare students for the on-site experience. The first activity (described herein) introduces students to topographic and geologic maps and their respective purposes. The second activity (Lake Mead Geologic WebQuest) is an inquiry-oriented activity designed to introduce students to the geology, landforms, geologic processes, and geologic timeline of Lake Mead NRA.

THEME

The landscape reveals its story in the features and formations you see today.

KEY QUESTIONS

What geologic forces and processes created the landscape in Lake Mead National Recreation Area?
What forces and processes are still at work today?

GOAL

Students will demonstrate understanding of the geologic forces and processes that created the landscape in Lake Mead NRA and the forces and processes that continue to impact and shape today's landscape.

OBJECTIVES

Students will:

- understand a topographic map and its relationship to landforms and features of the area it describes.
- understand a geologic map and its relationship to the various types of rocks that exist in different locations.

- be able to discuss why the information provided by topographic and geologic maps is important and how they both contribute to our understanding of the landscape.

NEVADA SCIENCE CONTENT STANDARDS

E.8.C.5. Students know how geologic processes account for state and regional topography.

CLARK COUNTY SCHOOL DISTRICT OBJECTIVES (GRADE 7)

Students will:

- use charts, graphs, tables, and maps to identify trends and provide explanations of various landforms.
- critique explanations and evidence presented by peers.
- present results and data to class.

SNAP CONSERVATION EDUCATION AND INTERPRETATION THEME CORRELATIONS

The on-site grade 7 activities support the following theme statement developed by Clark County-based educators:

- Sub theme 2. We share the intriguing stories of Southern Nevada's diverse, interconnected natural world.

This sub theme is derived from the guiding theme statement: Increasing human activity on highly sensitive and easily damaged lands has profoundly altered the natural environment of Southern Nevada, affecting native biota including threatened and endangered species and requiring active management of native and non-native species.

PREREQUISITE CLASSROOM EXPERIENCES

Lessons and discussions on:

- general purpose map use and reading (including direction and orientation)
- latitude and longitude (review if necessary)
A short animated movie on latitude and longitude is available online at:
www.infoplease.com/p/brainpop/latitudeandlongitude.html
- geology as a field of study
- igneous, metamorphic, and sedimentary rocks and specific examples and characteristics of each

Small group application in problem solving:

- formulating questions and analyzing problems
- using observations
- representing objects with symbols
- landmarks and orientation

VOCABULARY

- contour line
- geologic map
- igneous rock
- landform
- metamorphic rock
- observation
- sedimentary rock
- topography
- topographic map

PRE-VISIT LESSON: Geologic and Topographic Maps

Part 1 ▶ Introduction to Maps

This introductory activity is designed to review and strengthen students' general knowledge of maps and mapping.

1. Students are shown examples of different maps (e.g., road maps of states and cities, maps of the world, star maps, highway maps, small maps of regions that accompany news stories, and other maps as available). It would be especially useful to have different types of maps for the same place.
2. In groups of four, students brainstorm what types of information people can get from a map. The class shares their ideas, and the teacher records them on the board or on chart paper.
3. The teacher facilitates a discussion about the value of maps and the information that can be gained from them. Students consider (aloud or in their journals): *Why did people start creating maps? Why do we need many different maps of the same location? Why can't a single map show all possible information about a place? What are the advantages and the disadvantages of different kinds of maps?* Students should conclude that it is not possible to depict all of the possible information about a place on a single piece of paper, and that for a map to be understandable, it can contain only limited information.
4. Students are informed that over the next few days they will be learning about two types of special purpose maps (topographic and geologic) and the information that they can get from these maps. What they learn from these maps will help them better understand the earth and prepare them for a field trip on the Forever Earth houseboat at Lake Mead National Recreation Area.

TIME 30 minutes

MATERIALS

A collection of maps
 Student textbook, [Investigating Earth Systems](#)
 board or chart paper

Part 2 ▶ Topographic Maps

Topographic Maps: Topographic (“topo”) maps demonstrate 3-D topography on a flat piece of paper with curved lines called contour lines. Contour lines connect points of the same elevation. If you were to walk along a single contour line, you wouldn’t have to climb uphill or downhill. Elevation changes rapidly where lines are very close together (i.e., the area is very steep). Areas where lines are far apart have little elevation change (i.e., the area is relatively flat). The numbers you see on topographical maps are elevation in feet or meters.

1. Students are shown a topographic map. The teacher points out key features such as landforms (e.g., hills, valleys, cliffs, etc.), water features (e.g., streams, rivers, and lakes), and roads and other human-made structures. Students work alone and in small groups to answer questions on **Student Worksheet: Reading Topographic Maps**. (Note that the worksheet questions may be modified to suit the topographic map used.) The teacher reviews worksheet answers with the class and checks (see **Teacher Reference: Key to Reading Topographic Maps**) to make sure that students understand the basics of reading topographic maps.
2. In small groups (2-4 students), the class examines topographic maps of the local area. Groups can be given the same or different maps. See **Resources** (below) to obtain regional topographic maps. It is important that at least some of the maps provided include regions that will be visited on the Forever Earth trip. The teacher tells students that the topography learned in the classroom will be observed in real life on the field trip! Students answer the questions on **Student Worksheet: Regional Topography**.

Part 3 ▶ Geologic Maps

Geologic Maps: A geologic map shows the distribution of geologic features, including different kinds of rocks and faults. A geologic map is usually printed on top of a topographical map (the base map) to help the viewer locate him or herself on the map. The base map is printed with light colors, so it doesn’t interfere with seeing the geologic features on the map. The geology is represented by colors, lines, and special symbols unique to geologic maps. Understanding these features will allow you to understand much of the geology shown in almost any standard geologic map. The most striking features of

TIME 45 minutes

MATERIALS

Printed topographic maps

Student Worksheet: Reading Topographic Maps

Teacher Reference: Key to Reading Topographic Maps

Student Worksheet: Regional Topography

TIME 1.5 – 2 class periods

MATERIALS

Regional geologic maps

geologic maps are its colors. Each color represents a certain kind of rock of a given age range.

1. Students review the types of rocks they have studied (sedimentary, metamorphic, and igneous, and specific examples and characteristics of each type). Students look at the table at the bottom of page R9 in their student text book. The teacher facilitates a discussion on how geologists use information about the rocks in a specific area to help them understand the past. Ask the students questions such as: *How would you know by looking at the rocks that a volcano had erupted long ago in a particular area? What characteristics of a rock might make you believe that it is relatively “young” and was never very deep under the outer layer of rock and soil?*

The teacher explains that geologists display information about the rocks, faults, and other geologic features of a particular region on a special purpose map called a geologic map. Students look at the geologic map on page R10 in the student text. In small groups students discuss what information the map conveys. Each group should list 5 things that the map tells them. The class shares and discusses answers.

2. In small groups (2-4 students), the class examines geologic maps of the local area. Groups can be given the same or different maps. See **Resources** (below) to obtain regional geologic maps. Students complete **Student Worksheet: Geologic Map of Local Area**.

Next, students trace a portion of the geologic map onto tracing paper and use colors to shade the various types of rocks (discussed in Part 3.1, above) found in each location.

Students work as a team to develop a presentation about the area using the traced drawing and either real samples of rocks, or diagrams and descriptions (in students’ own words) of rocks found in each location. Students can use actual rocks if they are available, or sketches, diagrams, and/or pictures from the internet or books.

Part 4 ▶ Presentation of Findings

Students share their geologic presentations with the class, and explain the processes they used to create them.

Text book: [Investigating Earth Systems: An Inquiry Earth Science Program](#)

**Student Worksheet:
Geologic Map of Local Area**

tracing paper, art supplies, computer with internet access, color printer, photos of rocks from other sources, student-collected or teacher-collected rocks of different types

Important note: Only collect rocks from areas where you have permission to do so.

Part 5 ▶ Synthesis and Closure

Because they provide different information about the same location, both topographic and geologic maps add to our knowledge about the land. After completing the above topographic and geologic map activities, it is important that students demonstrate an understanding of the relationship between these two related tools, and the value of these tools for a scientist studying the land.

This closing activity should help the students focus on the relationship between the maps, the advantages and disadvantages of each type of map, and it will also help prepare the students to discuss some of the features they will see during their field trip on Lake Mead.

Working in small groups (3-4 students), students develop a list of what they can learn by studying a topographic map. Have groups share with the class and record on the board or chart paper.

Working in the same small groups, have students develop a list of what they can learn by studying a geologic map. Have groups share with the class and record on the board or on chart paper.

Discuss what the students have learned, highlighting the advantages of each map and the value to a scientist (e.g. documents and identifies elevations; various landforms such as cliffs, hills, mountains, valley, water; locates and identifies different types of rocks; identifies features such as folds and faults; can help in understanding the history of the land.)

Have each group look once again at the maps of the local region. Ask them as a group to choose one small location* on the map they might like to explore. Have each group complete **Student Worksheet: Where We Would Like to Explore**. Then, have each group share their location information and why they would like to explore it with the class.

***Note:** To guide students to choose locations they will actually be visiting, the teacher should consult with Forever Earth program manager to determine the areas at Lake Mead National Recreation Area where students will be traveling during their field trip. Remind students to look for their location when they are on the field trip.

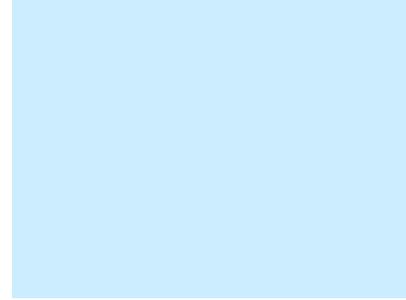
TIME 45 minutes**MATERIALS**

Chart paper

Student Worksheet: Where We Would Like to Explore

The teacher concludes with the following:

Now we know how to use both topographic and geologic maps. In the next activity, Lake Mead Geologic WebQuest, and on our Forever Earth field trip, you will use this skill to help you identify landforms and the geologic processes that created them.



EXTENSIONS

- Advanced students can locate topographic maps and geologic maps online for homework.
- Students investigate other areas such as a favorite vacation spot or someone's birth place and identify topographical and geological differences between the chosen place and the local region.
- In the final activity of the lesson, students are asked to identify specific locations that they will be visiting (as part of the upcoming field trip). At the field trip site, students record what they observe at the pre-identified location. During the field trip, discuss how the information on the maps helped them identify the location.

RESOURCES

Student text book

Smith, Michael J. [Investigating Earth Systems: An Inquiry Earth Science Program](#). Armonk, New York: It's About Time, Inc, 2006.

General Websites

U.S. Geological Survey Topographic Map Symbols:

<http://erg.usgs.gov/isb/pubs/booklets/symbols/>

Prentice Hall's Science Explorer interactive 3-D topographic map simulation by ForgeFX (*requires shockwave player*):

www.forgefx.com/casestudies/prenticehall/

click on "Play it" under the Topographic Map section

Geologic and Topographic Maps Online

U.S. Geological Survey site:

<http://usgs.gov>

www.usgs.gov/pubprod/

National Geologic Map Database (provides downloadable maps and hardcopy maps that can be ordered):

<http://ngmdb.usgs.gov/>

The following sites allow you to generate your own topographic maps, which can be printed at the size of your choice:

<http://mapserver.maptech.com/homepage/index.cfm>

www.topozone.com/

Local Map Retailers

Alan Bible Visitor Center (Lake Mead National Recreation Area)

Recreational Equipment Inc. (REI)

Sport Chalet

ADAPTATIONS FOR DIVERSE LEARNERS

- Consult with Forever Earth project manager prior to field trip to discuss specific needs of the class or individuals; decide which aspects of the program content or delivery to appropriately alter for culturally/linguistically, behaviorally, and cognitively diverse learners and for the gifted and talented.
- Implement peer assistance by strategically forming student groups.
- For the geologic map exercise, replace tracing with the following: provide copies of an existing, uncolored geologic map and have students color it appropriately (students can make a color key or the teacher can provide a color key).

ASSESSMENT

The teacher checks to ensure that handouts are completed correctly. The teacher carefully listens to the geologic map presentation and considers whether key concepts are included and represented accurately.

Groups are assessed according to ability to function and to self-monitor for task completion.