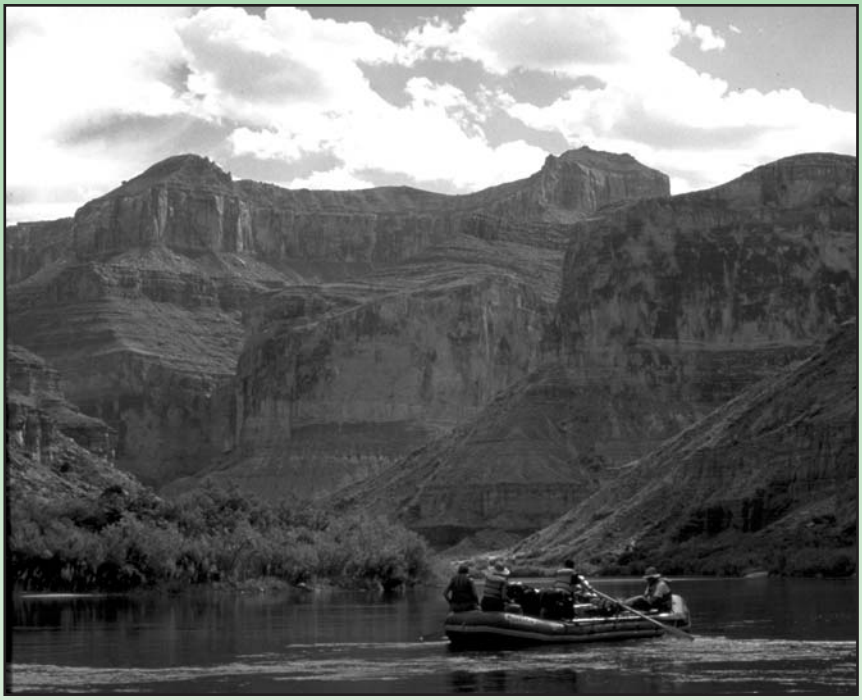
OVERVIEW

EARTH HISTORY COURSE



Human beings have used Earth's resources since prehistoric times. We made tools from stones. We mined raw materials to refine and manufacture into tools, utensils, shelters, ovens, and other useful items. We figured out how to extract precious metals from ores. We captured the energy of flowing streams behind dams and found numerous ways to put this power to use. We diverted water into channels for irrigation. And, because it is human nature to try to explain everyday phenomena, we made up stories to explain how Earth was created.

Middle school students should be able to exercise their inferential thinking, and the study of Earth history is made to order for this effort. They can begin to grapple with the earth's processes and systems that have operated over geological time. Students should make observations and do investigations that involve constructing and using conceptual models. They should generate questions for investigation, which may lead to new questions. Through their study of Earth history, students should become more confident in their ability to ask good questions and to recognize and use evidence from the rocks to come up with explanations of past environments.

FOSS AND NATIONAL STANDARDS

The **Earth History Course** emphasizes the use of knowledge and evidence to construct explanations about the processes and systems that have operated over geological time. This course supports the following National Science Education Standards.

SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the connections between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in scientific inquiry.
- Understand that different kinds of questions suggest different kinds of scientific investigations; current knowledge guides scientific investigations; mathematics and technology are important scientific tools.
- Understand that scientific explanations emphasize evidence.

CONTENT: EARTH SCIENCE

Develop students' understanding of Earth history and structure of Earth systems.

- Earth processes we see today are similar to those that occurred in the past.
- Fossils provide important evidence of how life and environmental conditions have changed.
- Solid Earth is layered, with a lithosphere, hot convecting mantle, and dense metallic core.
- Landforms are the result of a combination of constructive forces (crustal deformation, volcanic eruption, and deposition of sediments) and destructive forces (weathering and erosion).
- The rock cycle involves old rocks that break down to form the source of sediments that are buried, compacted, heated, and often recrystallized into new rocks.

HISTORY OF SCIENCE

Develop students' understanding of science as a human endeavor.

- Science requires different abilities, depending on such factors as the field of study and type of inquiry.
- Many individuals have contributed to the traditions of science.

FOSS MIDDLE SCHOOL PROGRAM COMPONENTS

FOSS Middle School is a general science curriculum for students and their teachers in grades 6–8. The curriculum is organized into topical courses under three strands: **Earth and Space Science, Life Science,** and **Physical Science and Technology**. Each course is an in-depth unit requiring 9–12 weeks to teach.

This course, designed for students in grades 7–8, includes the following interconnected components:

- A detailed ***Earth History Teacher Guide*** in a three-ring binder, including overview, materials preparation, goals and objectives, at-a-glance investigation chart, science background, lesson plans, transparency masters, teacher answer sheets, assessments with masters and scoring guides, CD-ROM user guide, and references (books, multimedia, websites). Each chapter of the teacher guide is separated by tabs for easy use. **Earth History** has eight investigations, each with two to six parts.
- **Kit of student laboratory equipment** packaged for multiple classes of 32 students each. The kit also contains class resource materials such as posters, maps, and videos. Each course is designed for one teacher working with five sections of students per day. The kit also includes **44 transparencies** for the investigations.
- ***FOSS Earth History Resources*** **book** containing images, data, and readings for each student.
- ***FOSS Earth History Lab Notebook*** containing 47 student sheets and organizers for the investigations. This can be a consumable book for each student or serve as a set of duplication masters for the teacher.
- ***FOSS Earth History*** **CD-ROM** for use as a whole-class demonstration tool as well as an individual or small-group interactive instructional tool. The CD-ROM is woven into the instruction and is linked to each investigation through the on-line Teacher Guide.

EARTH HISTORY COURSE MATRIX

SYNOPSIS	*SCIENCE CONCEPTS*	*THINKING PROCESSES*
1. PUSHING THE ENVELOPE (2 sessions)		
Students record their observations of several postmarked envelopes. They use the evidence to make inferences about the envelopes' origins, travels, and destinations. They consider how the processes of observation and making inferences contribute to answering questions.	• An observation is information gathered directly by using one or more of the five senses. • An inference is a logical conclusion based on observations and past experience.	• Make observations and generate evidence to support an idea. • Share study results with others for critical review. • Make inferences based on evidence.
2. INTO THE GRAND CANYON (4-5 sessions)		
Students observe and compare photos and rocks from the Grand Canyon and begin to generate questions about what they observe. They become familiar with contemporary history of the Grand Canyon and its environment, beginning with John Wesley Powell's scientific expeditions.	• The Grand Canyon is a natural landform located on the Colorado River. • The Grand Canyon's history involves both natural phenomena and human interactions.	• Use photographic and video images of rocks and landforms to gather data about the Grand Canyon. • Observe, describe, and compare rocks using appropriate tools. • Generate questions to guide further study.
3. GRAND CANYON ROCKS (4-5 sessions)		
Students observe and compare photographs and rocks exposed at two locations in the Grand Canyon. They correlate similar rocks at the two sites. They observe and compare images of the rock exposed at a number of locations on the Colorado Plateau and consider how differential erosion has shaped the landscape. They build the idea that rock layers make up the landform of the Colorado Plateau.	• Rock layers, such as those in the Grand Canyon, are three-dimensional features. • The sequence of rocks is the same from one location to another along the canyon; some rock layers are exposed at other sites on the plateau. • Differential erosion is caused by differences in the properties of the rock layers.	• Observe and compare photographs and rock samples representing two locations along the Colorado River in the Grand Canyon. • Use acid to test for the presence of calcium carbonate in a rock sample. • Identify and name three sedimentary rocks: limestone, sandstone, shale. • Correlate the rocks from two locations along the Colorado River. • Investigate how differential erosion has changed the landscape of the Colorado Plateau.
4. MY SEDIMENTS EXACTLY (6-9 sessions)		
Students investigate the processes of erosion and deposition and how they contribute to the formation of sedimentary rocks. They make sand and compare it to other sand samples. They observe erosion and deposition in a stream table and consider it in relationship to the source material for sandstone. They make sandstone in a basin, observe shale, and add a layer of shale to their basins.	• Sandstone and shale are sedimentary rocks formed through processes of weathering, erosion, and deposition. • Sediments turn into solid rock through the process of lithification. • The present is the key to the past.	• Investigate how sand can be made from larger rocks. • Identify the sediments in sandstone and shale. • Model the formation of layers of sandstone and shale in an ancient environment. • Relate the process of weathering, erosion, and deposition to the formation of sediments, sedimentary rock, and landforms.

FOSS CD-ROM	FOSS READINGS	EXTENSIONS
		• Give the right-handed challenge. • Begin researching careers in geology.
Auditorium • Powell River Trip Slide Show • *Grand Canyon* Expeditions Desk • *Grand Canyon Rim, Pima Point*	• *The Journal of John Wesley Powell* • *Getting to Know the Grand Canyon*	• Plan a trip to the Grand Canyon. • Read Powell's journal. • Discuss the human history at the Grand Canyon. • Research Native American activities.
Auditorium • *Colorado River* • *Colorado Plateau* Colorado Plateau Map Geology Lab • Earth Processes	• *From the Little Colorado to the Foot of the Grand Canyon*	• Compare river air distance to land distances. • Compare Grand Canyon 100 years later. • Investigate national parks. • Take virtual field trips.
Geology Lab • Sand Types • Earth Processes • Sedimentary Rocks, Sandstone • Sedimentary Rocks, Shale	• *Water on Mars?* • *Grand Canyon Flood!*	• Begin a class or personal sand collection. • Do web research on Mars. • Investigate geomorphology from space. • Read about the Ogallala Aquifer.

EARTH HISTORY COURSE MATRIX

SYNOPSIS	*SCIENCE CONCEPTS*	*THINKING PROCESSES*
5. LIMESTONE (4-5 sessions)		
Students observe limestone and create calcium carbonate by blowing into limewater. They observe fossils from the Grand Canyon and use this information to interpret the sequence of environments that existed in that region in the past.	• Limestone is a sedimentary rock composed mainly of calcium carbonate; it is formed by physical and biological processes. • Prehistoric environments can be inferred from evidence gathered from rocks and fossils.	• Identify sediments in limestone. • Investigate how carbon dioxide contributes to the precipitation of calcium carbonate in water. • Model the formation of limestone layers in an ancient environment.
6. IT'S ABOUT TIME (5-6 sessions)		
Students construct personal time lines to record their own history. They expand their understanding of time lines to construct geological timelines and begin to grapple with the large numbers that represent geographical time.	• Geological time extends from Earth's origin to the beginning of human history. • Earth's history is measured in millions of years.	• Create a personal time line from birth to the present. • Construct a time line of geological events and prehistoric life. • Apply the concept of time line to Earth history. • Determine the relative age of rocks, based on association with other rocks.
7. FOSSILS AND TIME (2-3 sessions)		
Students become familiar with how the fossil record contributes evidence to the reconstruction of Earth's past environments. They use index fossils to put layers of rocks from three locations on the Colorado Plateau into relative-age sequence. Students sequence 30 major events in the history of Earth (geological and biological).	• Index fossils can be used as indicators for the age of a sedimentary rock layer and for correlating rock layers. • Fossil evidence supports the law of fossil succession: organisms found as fossils change over geological time.	• Use index fossils to correlate rock layers in three locations on the Colorado Plateau. • Compare various events and fossils to derive a faunal succession over geological time. • Make inferences from fossil evidence that contribute to an understanding of fossil succession.
8. ONE ROCK TO ANOTHER (4-8 sessions)		
Students become familiar with igneous and metamorphic rocks and the processes that create them. They draw on their experiences with all rock types to build a concept of the rock cycle driven by constructive and destructive forces on Earth. They conduct an investigation into crystal formation in igneous rock, using salolcrystals. They revisit local rocks and conduct projects based on local geology.	• Igneous rocks form from molten rock and can be described as extrusive or intrusive. • Metamorphic rocks form when heat and pressure change existing rocks. • Igneous, metamorphic, and sedimentary rocks can change from one to another over time.	• Observe and compare the properties of sedimentary, igneous, and metamorphic rocks. • Relate the formation processes of the three types of rocks to develop the rock cycle. • Relate the size of crystals in igneous rocks to environmental variables.

FOSS CD-ROM	FOSS READINGS	EXTENSIONS
Geology Lab • Sedimentary Rocks, *Limestone* Auditorium • *Modern Environments*	• *Where in the World Is Calcium Carbonate?* • *Coconino Stories*	• Revisit local rocks. • Visit local sedimentary environments. • Investigate building materials.
	• *Fossils, Rocks, and Time* • *Floating on a Prehistoric Sea*	• Describe a million. • Prepare other time lines. • Use *TimeLiner* software. • Explore the U.S. Map. • View Colorado Plateau over Time on the FOSS CD-ROM.
Time Room • Time Machine	• *A Fossil Primer*	• Look for fossils. • Make fossils. • Track an animal. • Think about "modern" fossils.
Geology Lab • Rock Database Expeditions Desk • Bright Angel Trail • Yosemite National Park • Hawaii Volcanic National Park Time Room • Colorado Plateau over Time	• *The Story of the Wrightwood Marble* • *Crystals, Minerals, and Rocks* • *Careers in Geology* • *Destroying and Reconstructing Earth*	• Assign Colorado Plateau history projects. • Read about careers in geology. • Raft the Colorado River. • Make "breadrock." • Invite a geologist to class.

FOSS TEACHER GUIDE

The ***Earth History Teacher Guide*** is just that—a guide. It is designed to be an information and planning tool to help you understand and enjoy your visit to the Grand Canyon and through geological time, much like an interpretive brochure might guide your visit to a national park. A good guide will suggest the best path to follow, and will enrich your visit with history, facts, and lore as you proceed. Like any good guide, it will also point out places to rest, where to stop for refreshments. You should feel comfortable and confident that you know what you are doing as you go along.

Like a good guide, it may be pressed into service less as you become more and more familiar with the territory. On your third visit to the park, you might head straight for a specific location, passing by some of the introductory exhibits, and you might visit your favorite spots in a slightly different order than you did before. You might even leave the trail here and there to drink in some of the historical ambiance in a way quite different from that intended by the preparer of the guide brochure.

The first time you visit the **FOSS Earth History Course**, we hope you will follow our suggested sequence to get the lay of the land. The guide is filled with information to help you have an excellent first use of the course. It may seem overwhelming at first, but in a short time you will discover how to use it effectively.

Here's what we suggest:

Look at the **Table of Contents** to see how the teacher guide is assembled. You'll notice that the guide is subdivided into 18 chapters. Turn each tab to see how much information there is in each section.

Next read the **Overview** chapter completely. This describes the scope of the course content and discusses issues of instruction, assessment, management, and safety.

Now turn all the pages in the guide, pausing to read the **Goal and Objectives** of each investigation carefully. In this way, you will be able to get a very good sense of the curriculum.

Finally, digest Investigation 1, *Pushing the Envelope,* very thoroughly. Read the science background carefully and study the **investigation at-a-glance chart** to see how the investigation is subdivided. The chart also provides a dissected overview of the several days of classroom actions, including the use of media (CD-ROM, video, and readings) and the assessments. Project the actions you read about into your classroom. Visualize students grappling with the issues and working with materials in small groups. If you have the kit at hand, bring out the materials as you read, and do the investigations. Then read Investigation 2 carefully, then 3, 4, 5...Keep the *Earth History Teacher Guide* close at hand (even in hand) during your geological trip to ensure a safe and productive adventure.