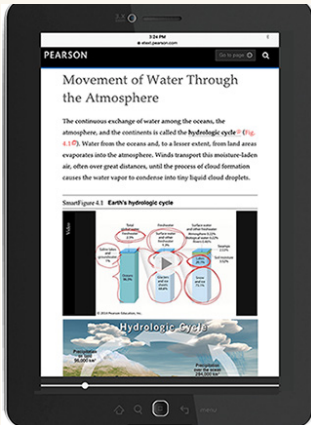
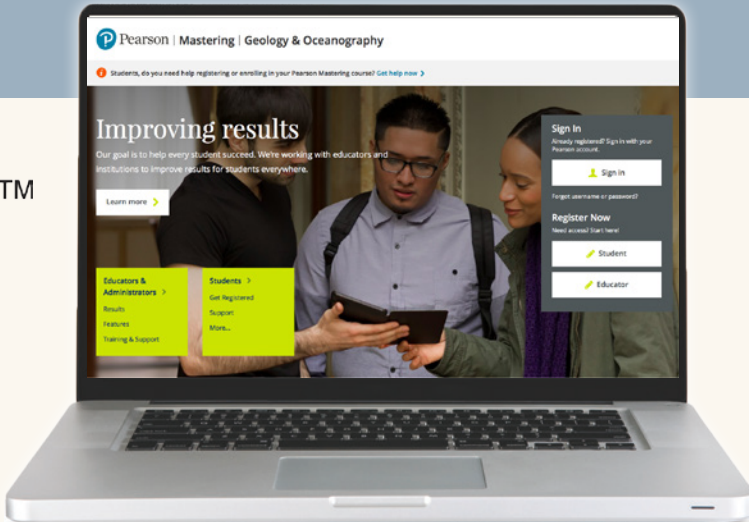


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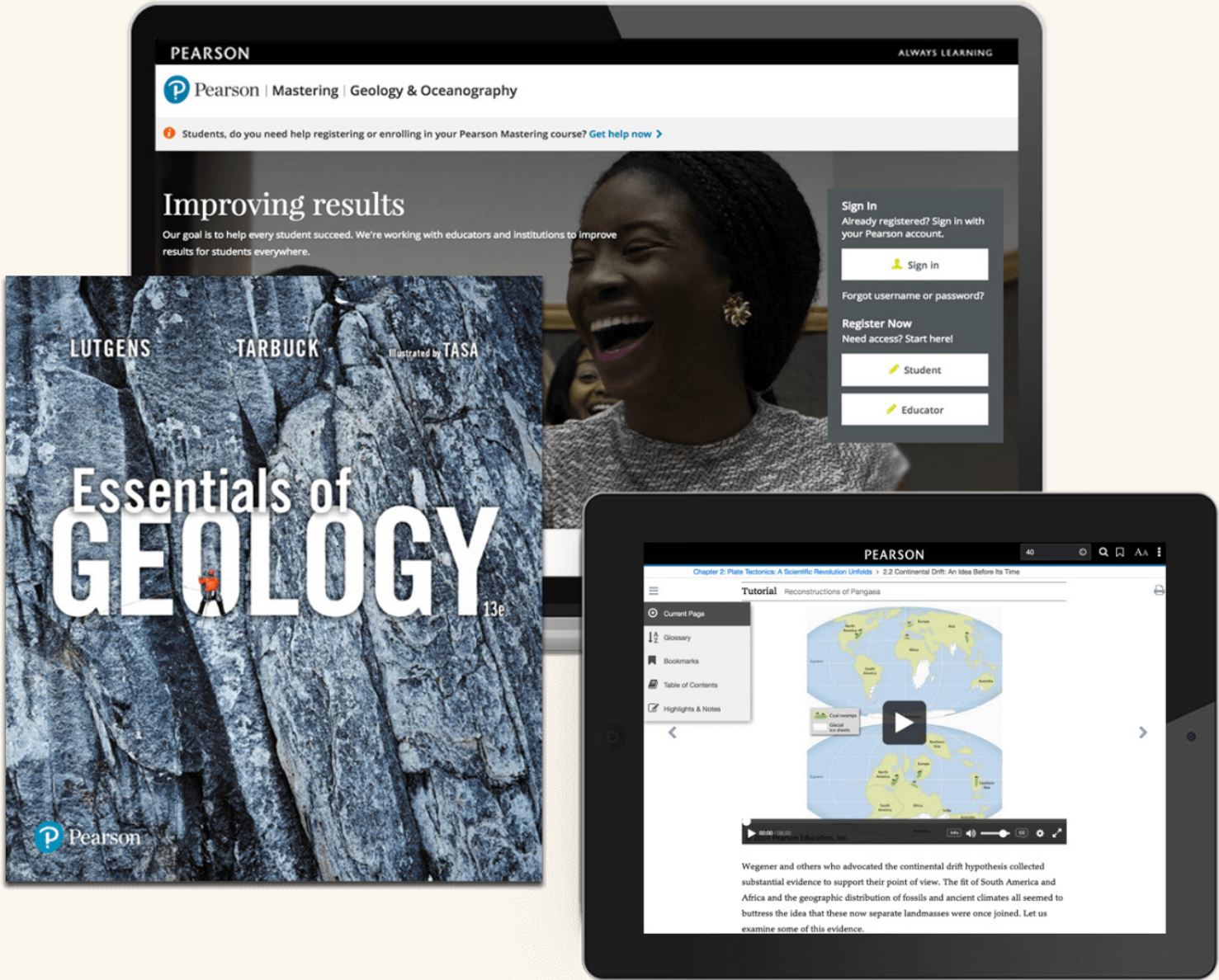
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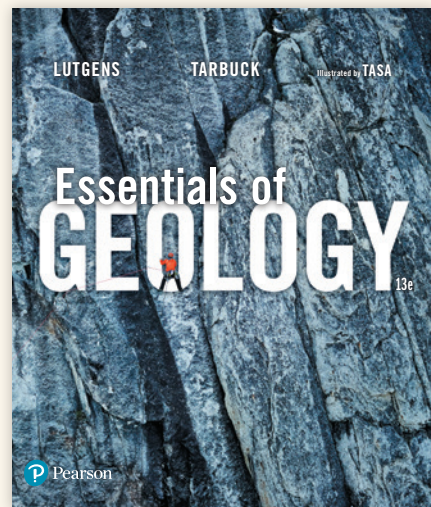
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## Using dynamic media to bring geology to life

From the renowned Lutgens/Tarbuck/Tasa team, the **13th Edition** of ***Essentials of Geology*** continues to elevate the text's readability, illustrations, focus on basic principles, and instructor flexibility. This edition incorporates a structured learning path and reliable, consistent framework for mastering the chapter concepts. With a fully integrated mobile media program that includes new Mobile Field Trip and Project Condor quadcopter videos as well as new animations and videos, this edition provides a unique, interactive, and engaging learning experience for your students.

## Active Learning Path

Most chapters have been designed to be self-contained so that materials may be taught in a different sequence, according to the preference of the instructor or the needs of the laboratory. Thus, an instructor who wishes to discuss erosional processes prior to earthquakes, plate tectonics, and mountain building may do so without difficult

# 1

## An Introduction to Geology

**FOCUS ON CONCEPTS**

- 1. Describe the scientific method and how it applies to geology.
- 2. Explain the difference between geology and other earth sciences.
- 3. List the major branches of geology and their subfields.
- 4. Describe the geologic time scale and its subdivisions.
- 5. Explain the difference between geologic time and human time.
- 6. List the major geologic eras and their subdivisions.
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- 8. List the major geologic eras and their subdivisions.
- 9. Explain the difference between geologic time and human time.
- 10. List the major geologic eras and their subdivisions.

### CONCEPT CHECKS 1.8

1. Compare and contrast continents and ocean basins.
2. Name the three major regions of the ocean floor. What are some features associated with each?
3. Describe the general distribution of Earth's youngest mountains.
4. What is the difference between shields and stable platforms?

### GIVE IT SOME THOUGHT

1. The length of recorded history for humankind is about 5000 years. Clearly, most people view this span as being very long. How does it compare to the length of geologic time? Calculate the percentage or fraction of geologic time that is represented by recorded history. To make calculations easier, round the age of Earth to the nearest billion.
2. After entering a dark room, you turn on a wall switch, but the light does not come on. Suggest at least three hypotheses that might explain this observation. Once you have formulated your hypotheses, what is the next logical step?
3. Refer to the figure in Figure 1.13 to answer the following questions.
  - a. If you were to climb to the top of Mount Everest, how many breaths of air would you have to take at that altitude to equal the amount of air in one breath at sea level?
  - b. If you are flying in a commercial jet at an altitude of 12 kilometers (about 30,000 feet), about what percentage of the atmosphere's mass is below you?

### CONCEPTS IN REVIEW

## Plate Tectonics: A Scientific Revolution Unfolds

### 2.1 From Continental Drift to Plate Tectonics

Summarize the view that most geologists held prior to the 1960s regarding the geographic positions of the ocean basins and continents.

Fifty years ago, most geologists thought that ocean basins were very old and that continents were fixed in place. Those ideas were discarded with a scientific revolution that revitalized geology: the theory of plate tectonics.

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4. Making accurate measurements and observations is a basic part of scientific inquiry. Identify two images in this chapter that illustrate a way in which scientific data are gathered. Suggest an advantage that might be associated with the examples you select.

## Straight From the Headlines




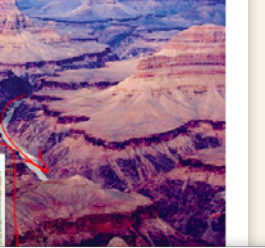
## Dynamic Art Program

1



**Geologist's Sketch**





**CONCEPTS IN REVIEW**

### Crustal Deformation & Mountain Building

▶ 02:20 | 11.1 Crustal Deformation, III


**11.1 Crustal Deformation**

Describe the three types of differential stress and identify the resulting surface most commonly associated with each. Differentiate stress from strain and brittle from ductile deformation.


**11.1.1 Tectonic deformation, tectonic structure (geoclinal, stress, confining pressure, differential stress, compressional stress, tensional stress, shear stress, plastic deformation, brittle deformation, ductile deformation)**


- Tectonic (geologic) structures are structures generated when rocks are deformed by bending or breaking; they include folds, faults, and joints.
- Stress is the force that drives rock deformation. When stress acts equally from all directions, we call it **confining pressure**. When the stress is greatest in one direction we call it **differential stress**. There are three main types of differential stress: compressional, tensional, and shear.
- A rock's strength is its ability to resist permanent deformation. When the pressure on a rock is equal in strength, the rock deforms, usually by folding or faulting.
- Brittle deformation is caused by spontaneous stretching of the chemical bonds in a rock. When the stress is released, the rock returns to its original shape. When the rock's strength is exceeded, bonds break, and the rock deforms in either a brittle or ductile fashion. Brittle deformation fractures rocks, whereas ductile deformation changes a rock's shape.

2



- Whether a rock deforms in a brittle or ductile manner depends on its temperature and its confining pressure. The hotter a rock, the more likely it is to experience ductile deformation. Greater confining pressure makes a rock stronger and less likely to break. Thus, rock deformation tends to be brittle in the shallow crust and ductile at deeper levels.
- Whether deformation is brittle or ductile also depends on the type of rock. For example, clay is weaker than granite, so it is more prone to ductile deformation. If rock is forced to deform more quickly than can be accommodated by the slow processes of ductile deformation, it will break.
- Find the quarter on the left by accompanying image experience brittle or ductile deformation?





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**NEW & UPDATED | Geology topics** pulled straight from the headlines, including the treatment of energy resources, the 2015 Nepal earthquake, the 2013 Bingham Canyon Copper Mine landslide, vanishing wetlands, the impact of prolonged drought on groundwater resources, Superstorm Sandy, the USGS Community Internet Intensity Map project, rising CO<sub>2</sub> levels, global climate change, and much more, keep students up-to-date with the latest geologic events.

**(1) Illustrations** by Dennis Tasa, a gifted artist and respected geoscience illustrator, provide a dynamic visual story of geology. Cutting edge photorealism and photo comparisons guide students more clearly than ever before. **(2) Geologist Sketches** are incorporated into the text's visual program, with photographs side-by-side hand "sketch" versions of the same image. This visual feature encourages students to see the world through the eyes of a professional geologist.

A four-part learning path facilitates active learning, allowing students to focus on important ideas and pause to assess their progress at frequent intervals: **(1) Focus on Concepts** are numbered learning objectives that correspond to each major section of the chapter. **(2) Concept Checks** allow students to monitor their understanding of significant facts and ideas within each chapter. **(3) Concepts in Review** provide a concise overview of key ideas by using photos, diagrams, and questions that test students' understanding of core concepts. **(4) Give It Some Thought** questions and problems, relating back to each chapter's learning objectives, challenge students by involving them in activities that require higher-order thinking skills.

## Bring Field Experience to Students' Fingertips...

Teachers can incorporate dynamic media into lecture, such as Videos, MapMaster Interactive Maps, and Geoscience Animations.

▶ **SmartFigure 2.14**  
**East African Rift valley**  
 The East African Rift valley represents the early stage in the breakup of a continent. Areas shown in red consist of lithosphere that has been stretched and thinned, allowing magma to well up from the mantle.

**CONDOR VIDEO**  
<https://goo.gl/RVwqg1>

**NEW! QR Codes link** out to SmartFigures Quick Response (QR) codes link out to over 200 videos and animations, giving readers immediate access to five types of dynamic media: Project Condor Quadcopter Videos, Mobile Field Trips, Tutorials, Animations, and Videos to help visualize physical processes and concepts. SmartFigures extend the print book to bring geology to life.

**NEW! SmartFigure: Project Condor**  
**Quadcopter Videos** Bringing Physical Geology to life for geology students, three geologists, using a quadcopter-mounted GoPro camera, have ventured into the field to film 10 key geologic locations and processes.

To learn more about this program including components and MasteringGeology with Pearson eText, visit [www.PearsonSchool.com/Advanced](http://www.PearsonSchool.com/Advanced)