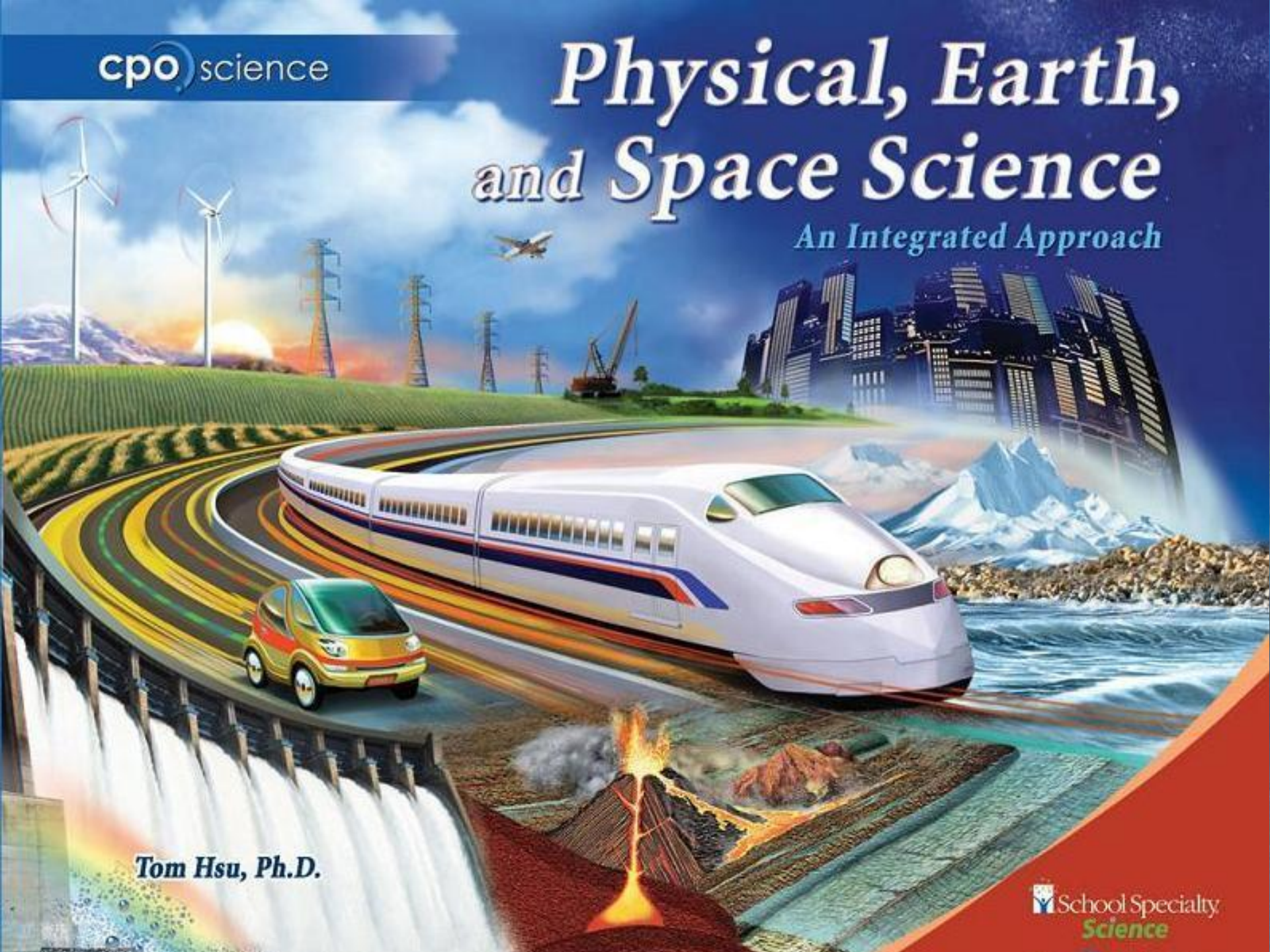
cpo science

Physical, Earth, and Space Science

An Integrated Approach

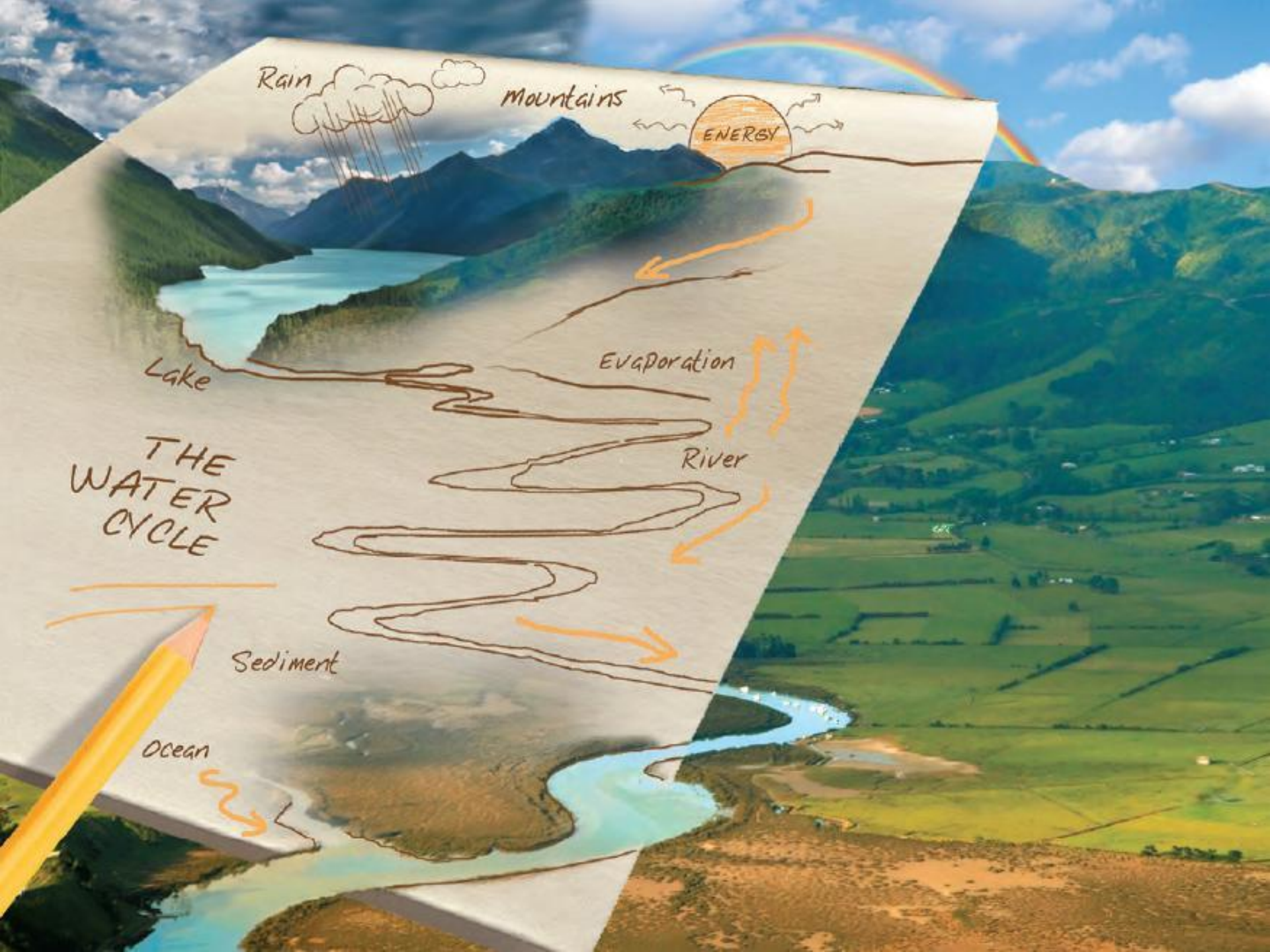


Tom Hsu, Ph.D.

School Specialty Science

UNIT SEVEN: Earth's Water

- Chapter 21 Water and Solutions
- Chapter 22 Water Systems
- Chapter 23 How Water Shapes the Land


Rain
Mountains
ENERGY
Lake
Evaporation
River
THE WATER CYCLE
Sediment
Ocean

Chapter Twenty-Three: How Water Shapes the Land

- 23.1 Weathering and Erosion
- 23.2 Shaping the Land
- 23.3 Sedimentary Rocks

Chapter 23.1 Learning Goals

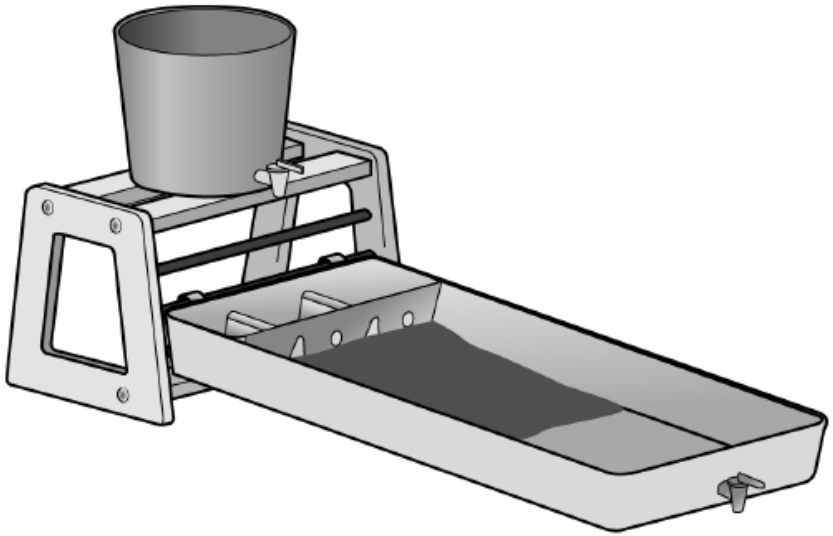
- Define weathering and erosion.
- Distinguish between mechanical and chemical weathering.
- Apply knowledge forces to explain how sediment is moved.

Investigation 23A

Water Systems

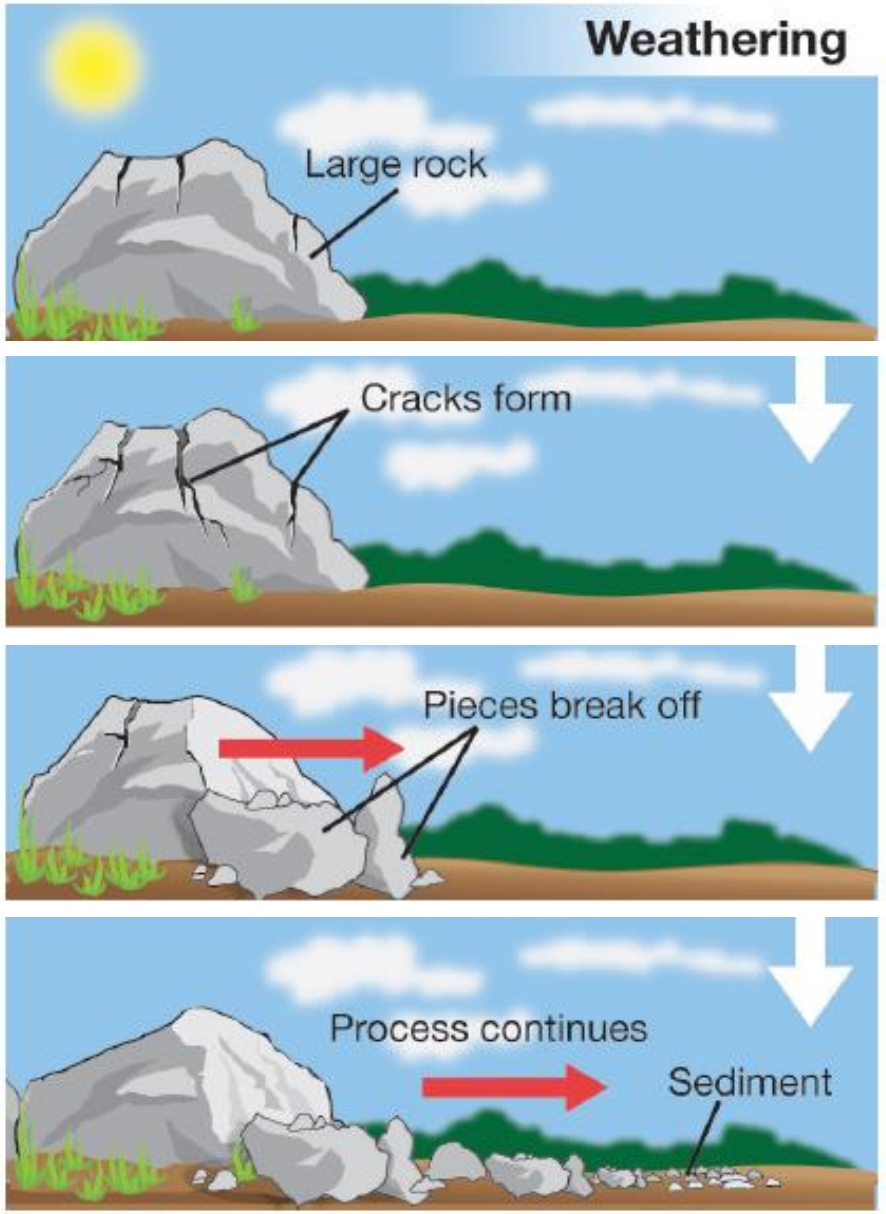
- ***Key Question:***

  How does running water shape rivers and landscapes?



23.1 Weathering and erosion

- * *Weathering* is the process of breaking down rocks and minerals in place.
- * Eventually rock bits and pieces become *sediment.*



23.1 Weathering and erosion

- * *Erosion* is the process of moving pieces of rock and sediment by wind, water, ice, and gravity.
- * Earth's internal energy and the Sun are the two main sources of energy that cause weathering and erosion.

23.1 Forms of weathering

- ***Mechanical (Physical) weathering* occurs when forces break or chip rocks and minerals into smaller pieces without changing their composition.**

23.1 Forms of weathering

- * Rock is also reduced to smaller pieces by chemical reactions between water and rock grains.
- * This process is called *chemical weathering*.

Weathering

Mechanical weathering

Chemical weathering

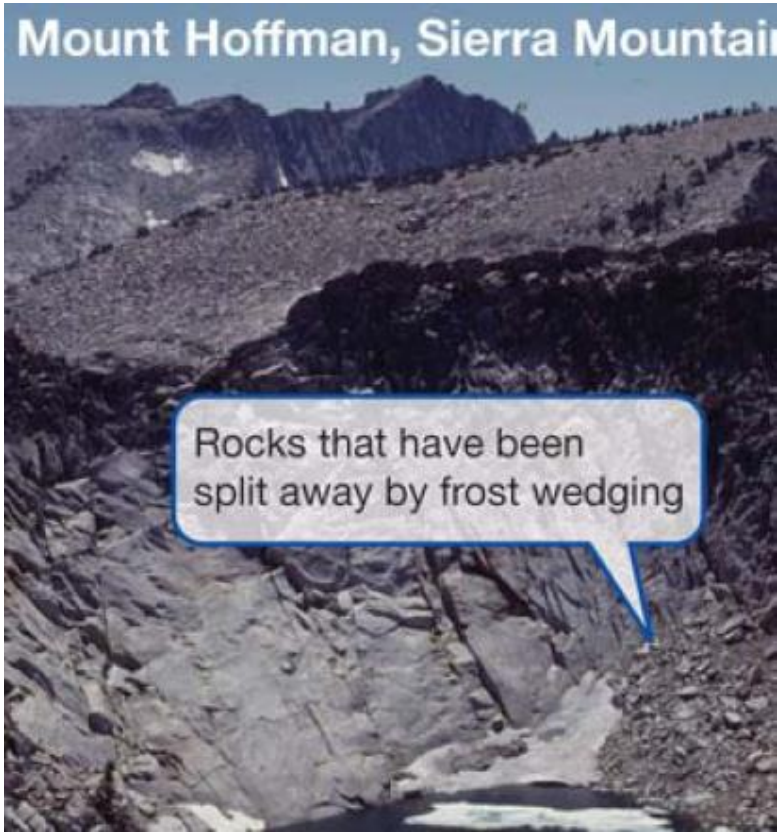
Photo courtesy of Jim Sammons, Sammons' INK.

23.1 Soil results from weathering

- * In time, sediment combines with organic matter, making a rich mixture called *soil*.
- * Soil includes air, water, and living organisms such as bacteria, fungi, and insects.

23.1 Processes of mechanical weathering

- * *Frost wedging* splits apart rock slowly as water freezes.
- When ice expands and water contracts, it causes cracks in rock.

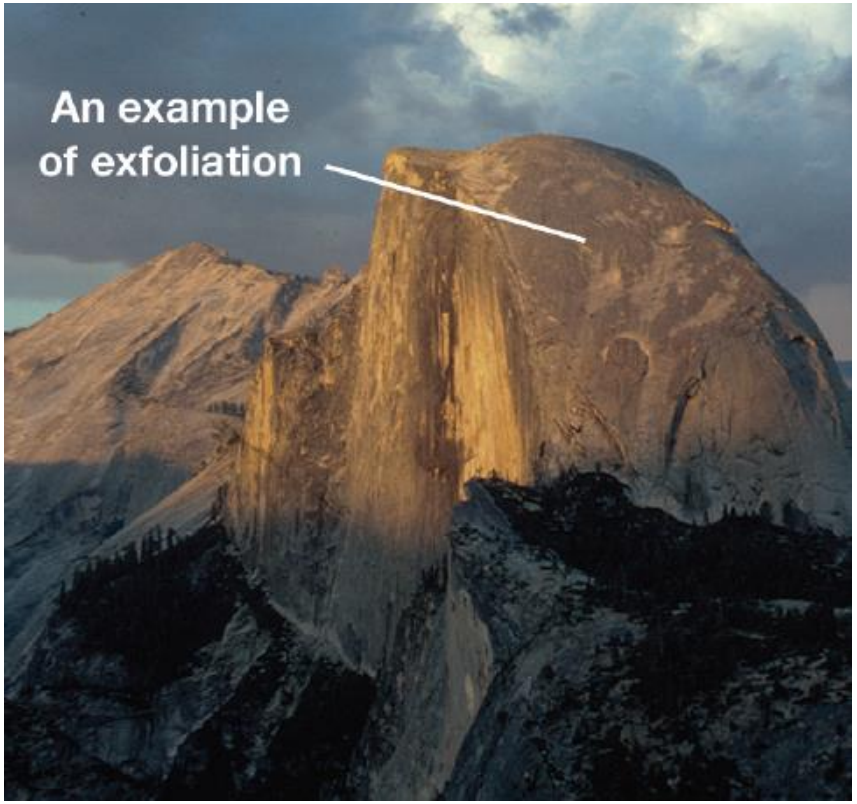


Sunglasses shown for scale

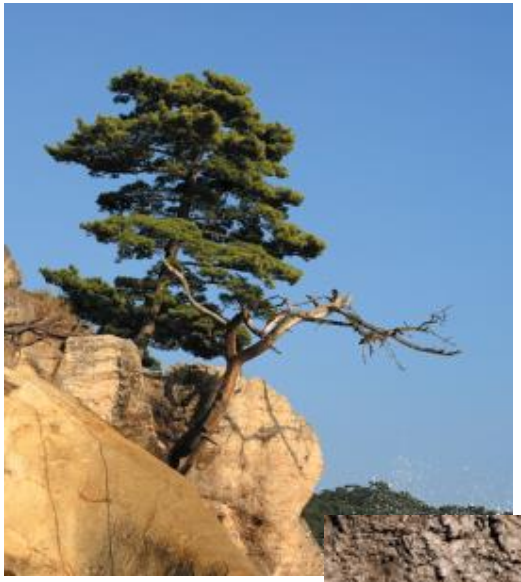
Salt weathering of stone bricks

23.1 Processes of mechanical weathering

- * *Exfoliation* is a weathering process that results in rock layers peeling away as they expand or contract.
- Expansion caused cracking of the newly exposed rock.
- * A combination of erosion, *unloading*, and exfoliation caused pieces of the rock to break off.



23.1 Processes of mechanical weathering



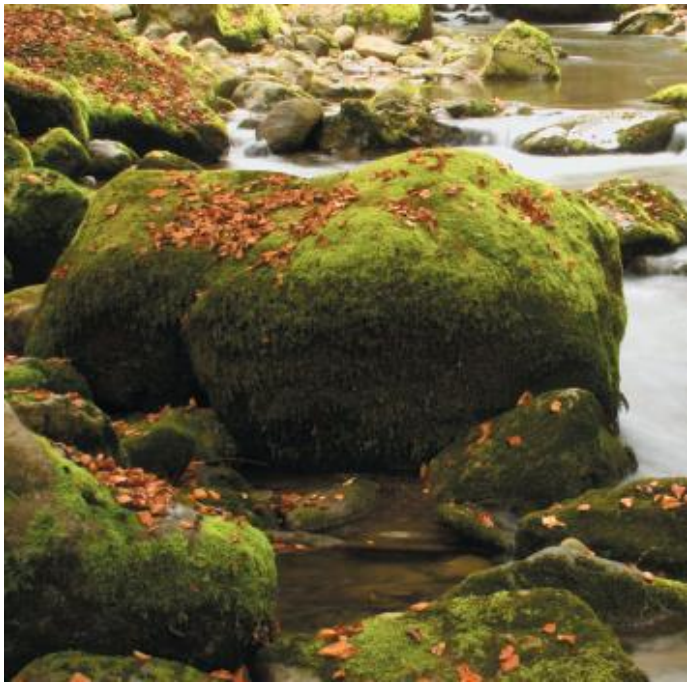
- ***Plants cause *biological weathering* when their roots grow into small cracks in a rock.**
- **Animals cause biological weathering when they dig into soil or burrow underground.**

23.1 Agents of chemical weathering

* **Chemical changes can happen when rocks or minerals are exposed to:**

1. **water,**
2. **acid rain, or**
3. **oxygen.**

Moss and lichens on rocks eventually cause them to break down because of chemicals they release.



Biological Weathering

Causes both mechanical and chemical weathering

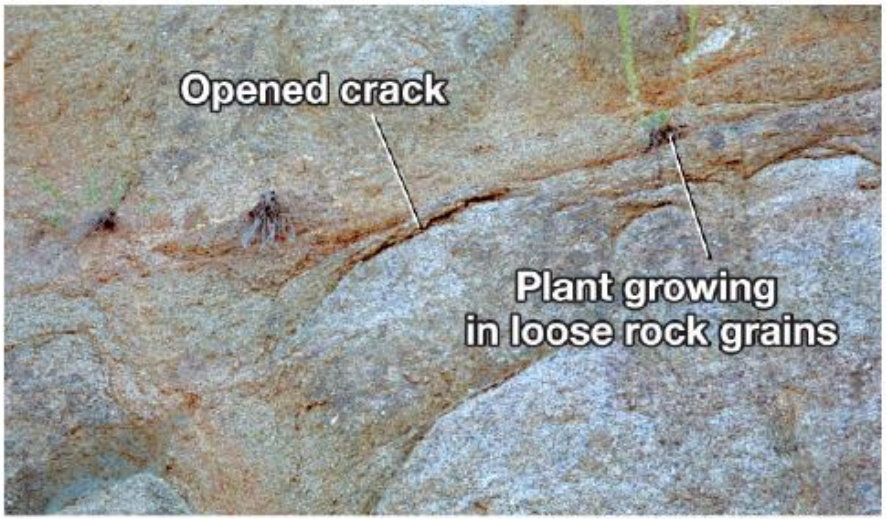
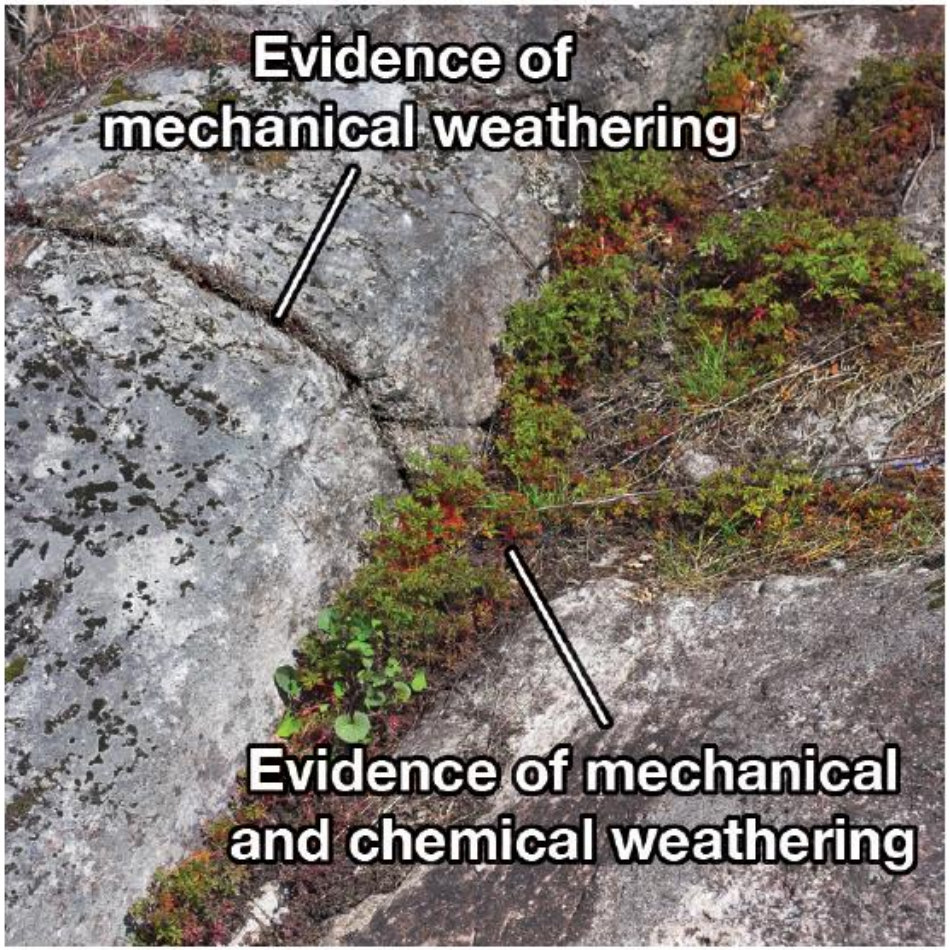


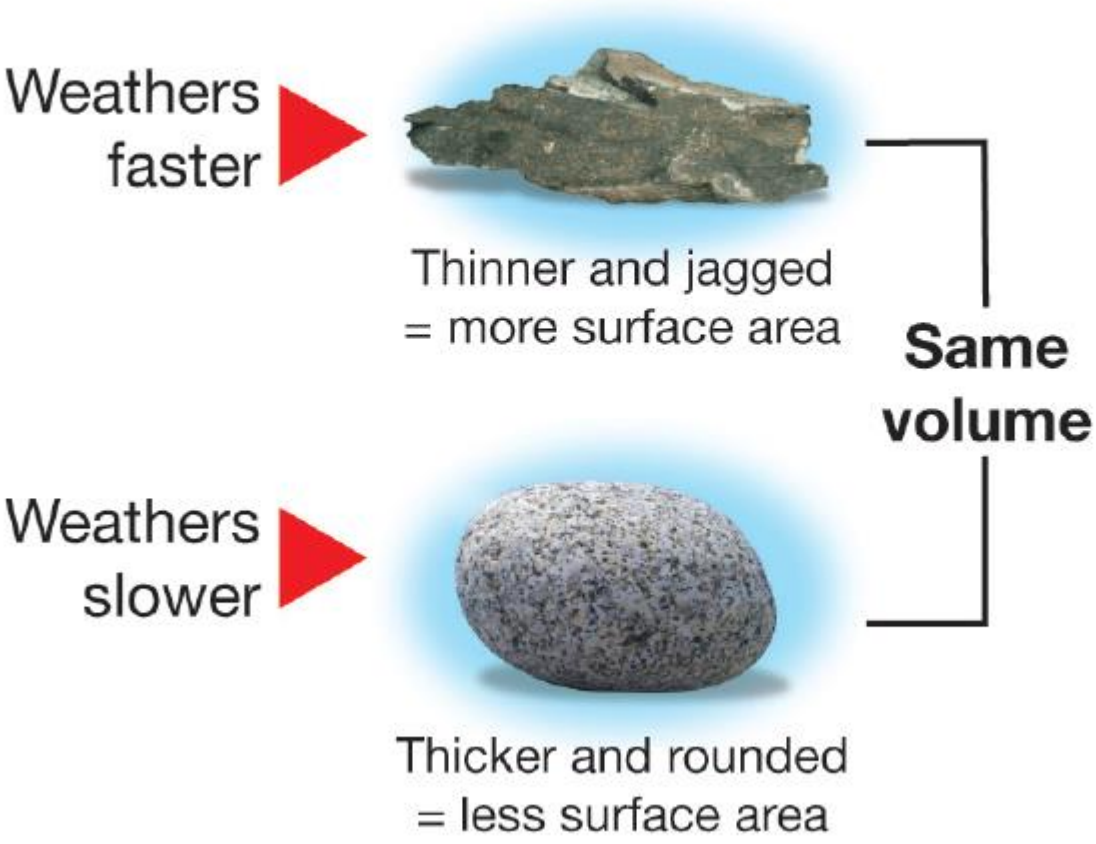
Photo courtesy of Jim Sammons, Sammons' INK.

23.1 Agents of chemical weathering



- * Both physical and chemical weathering can affect rock at the same time.

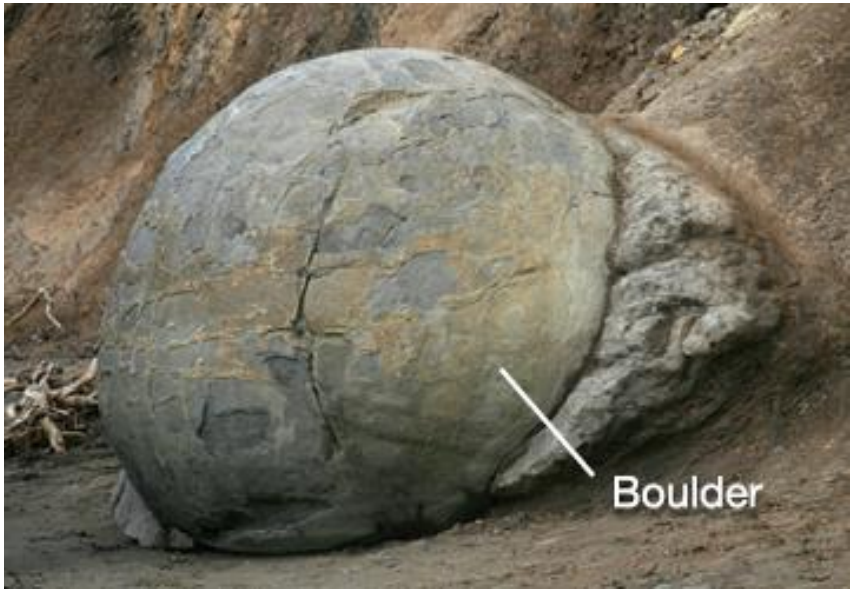
23.1 Factors that affect weathering



23.1 Erosion

- * Through erosion, rock, rock pieces, sediment, and soil are transported by water, wind, ice, and other agents.
- * Beach dunes hold large amounts of wind deposited sand.
- * *Loess* is another wind-blown deposit of fine sediment.

23.1 Erosion



- * Water is a powerful force involved in erosion.
- This boulder has moved only a little since it was exposed but the material surrounding it eroded.

23.1 Moving sediment by gravity

- * ***Mass wasting*** **is the downhill movement of large amounts of rock and sediment due to the force of gravity.**

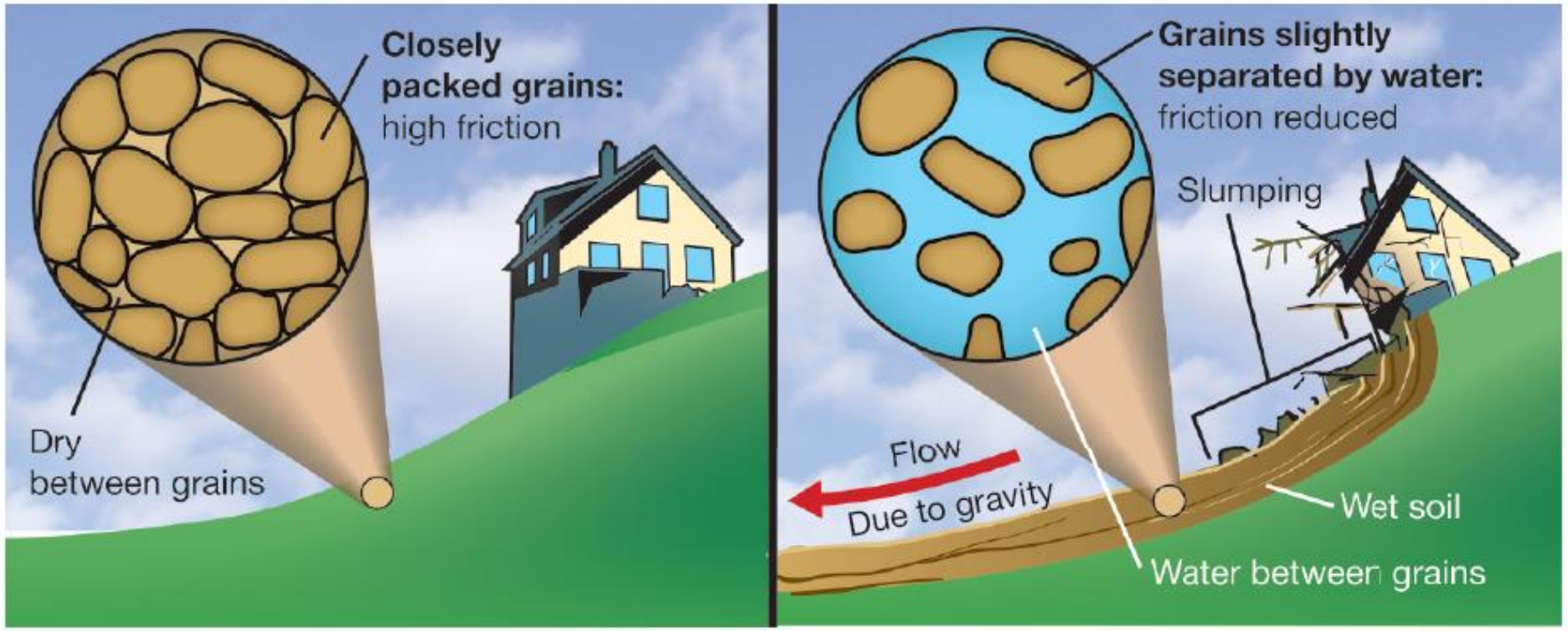
23.1 Moving sediment by gravity

- * A landslide occurs when a large mass of soil or rock slides down a steep slope.

Mass Wasting

The downhill movement of large amounts of rock and sediment due to the force of gravity.

Example: Slumping



Other types: landslide, rockfall, mudflow

23.1 Moving sediment by gravity

- * *Slumping* describes what happens when loose soil becomes wet and slides or “slumps”.
- Slumping can happen after a period of very heavy rainfall.