Chapter 8
Earth Systems and Resources

The Earth's resources were determined when the planet formed.

Earth formed roughly 4.6 billion years ago from cosmic dust in the solar system *(first sign of life was 3.7 billion yrs, sign of animal life was 800 mil yrs ago, evolvement of humans was 200,000 yrs ago)*

This determined the distribution and abundance of elements and minerals today (started with high CH4, lack of O2, 2.4 bil yrs ago…cyanobacteria)

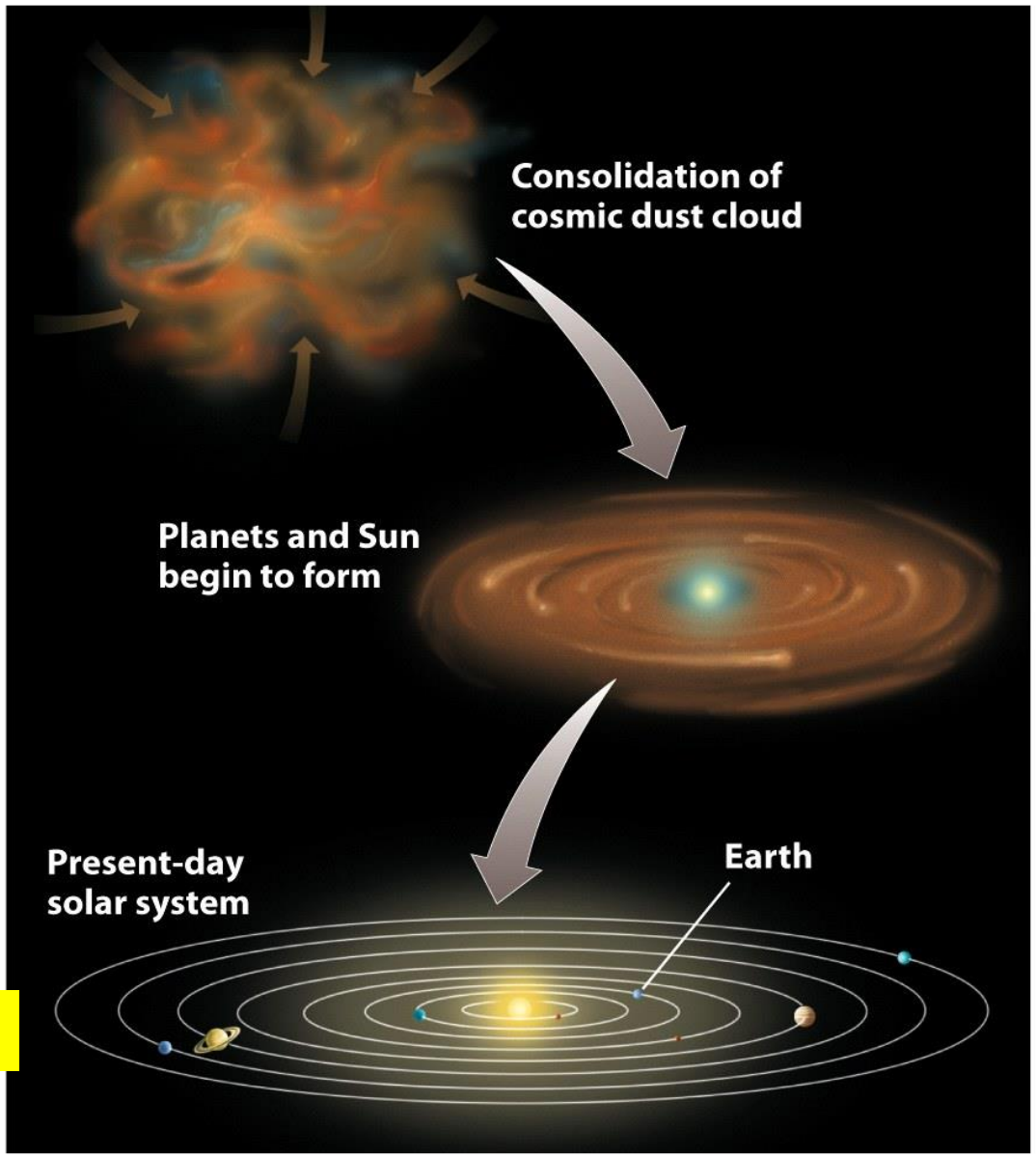

Figure 8.1
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Weathering and Erosion

- **Weathering-** when rocks are exposed to air, water, certain chemicals or biological agents that degrade the rock.

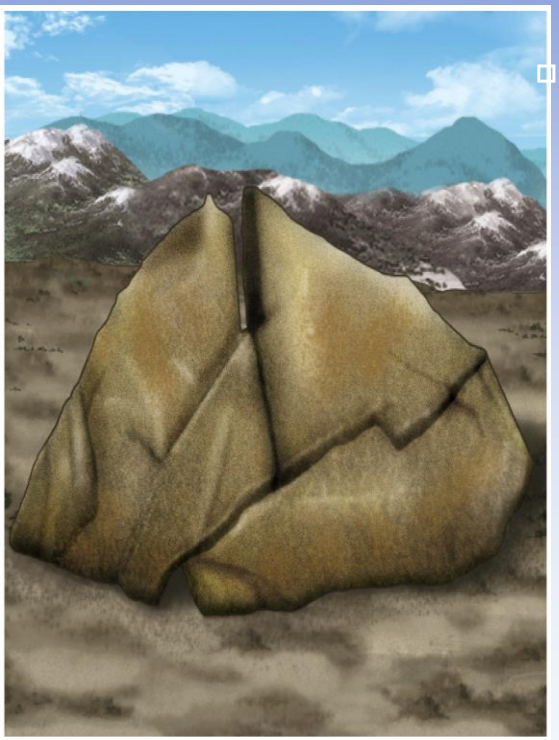


Figure 8.16a
Environmental Science

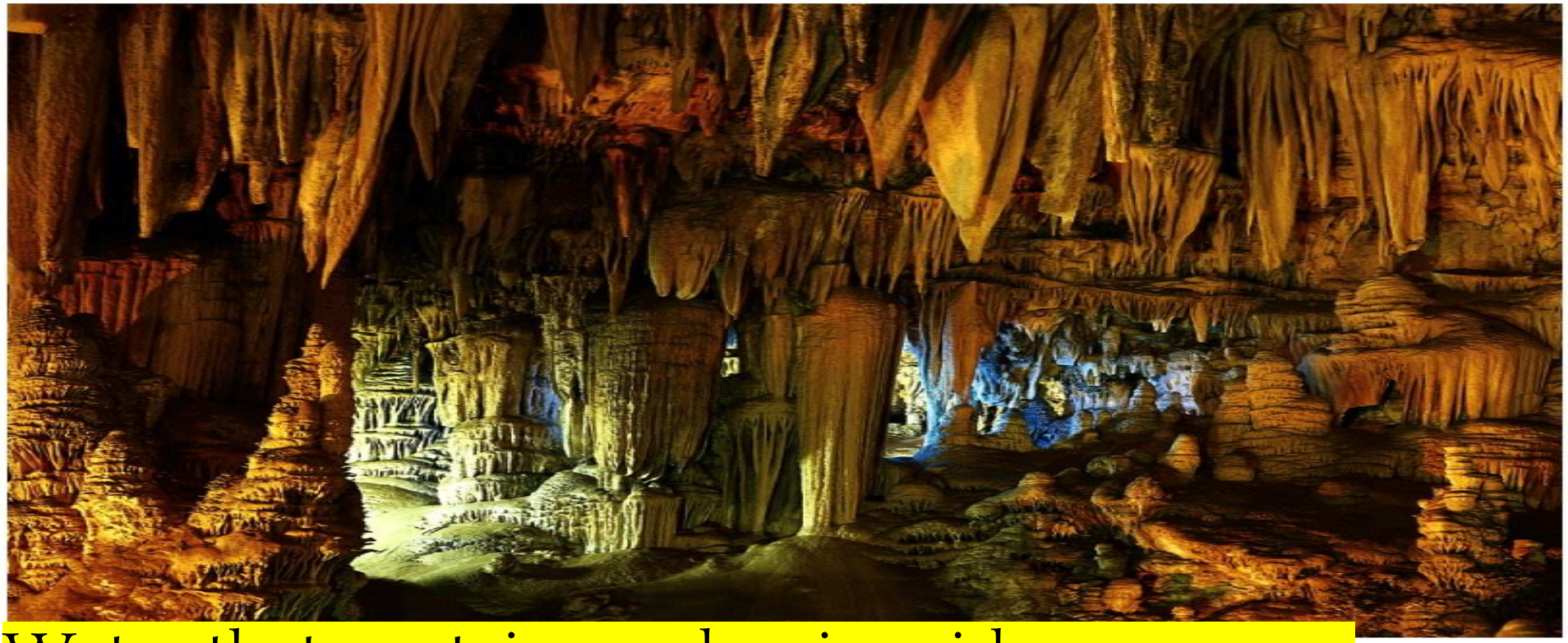
- water in cracks, expand when freeze

Figure 8.16b
Environmental Science

Physical weathering - the mechanical breakdown of rocks and minerals. (roots from trees)

Weathering and Erosion

- **Chemical weathering-** the breakdown of rocks and minerals by chemical reactions.



Water that contains carbonic acid wear away limestone, forming caves like above.

Erosion

- **Erosion**- the physical removal of rock fragments from a landscape or ecosystem. *Wind, water, ice transport and living organisms can erode materials*.
  - **Natural process**...poor land use practices (deforestation, overgrazing, road building..etc) can accelerate erosion *(erosion leads to deposition of the eroded material somewhere else)*

- **Deposition**- the accumulation or depositing of eroded material such as sediment, rock fragments or soil.

Soil

- Soil is important because it...
  1. Is a **medium** for plant growth (Sand, Slit, Clay)
  2. Serves as a **filter** for **water**
  3. A **habitat** for living organisms
  4. Serves as a **filter** for **pollutants (Clay)**

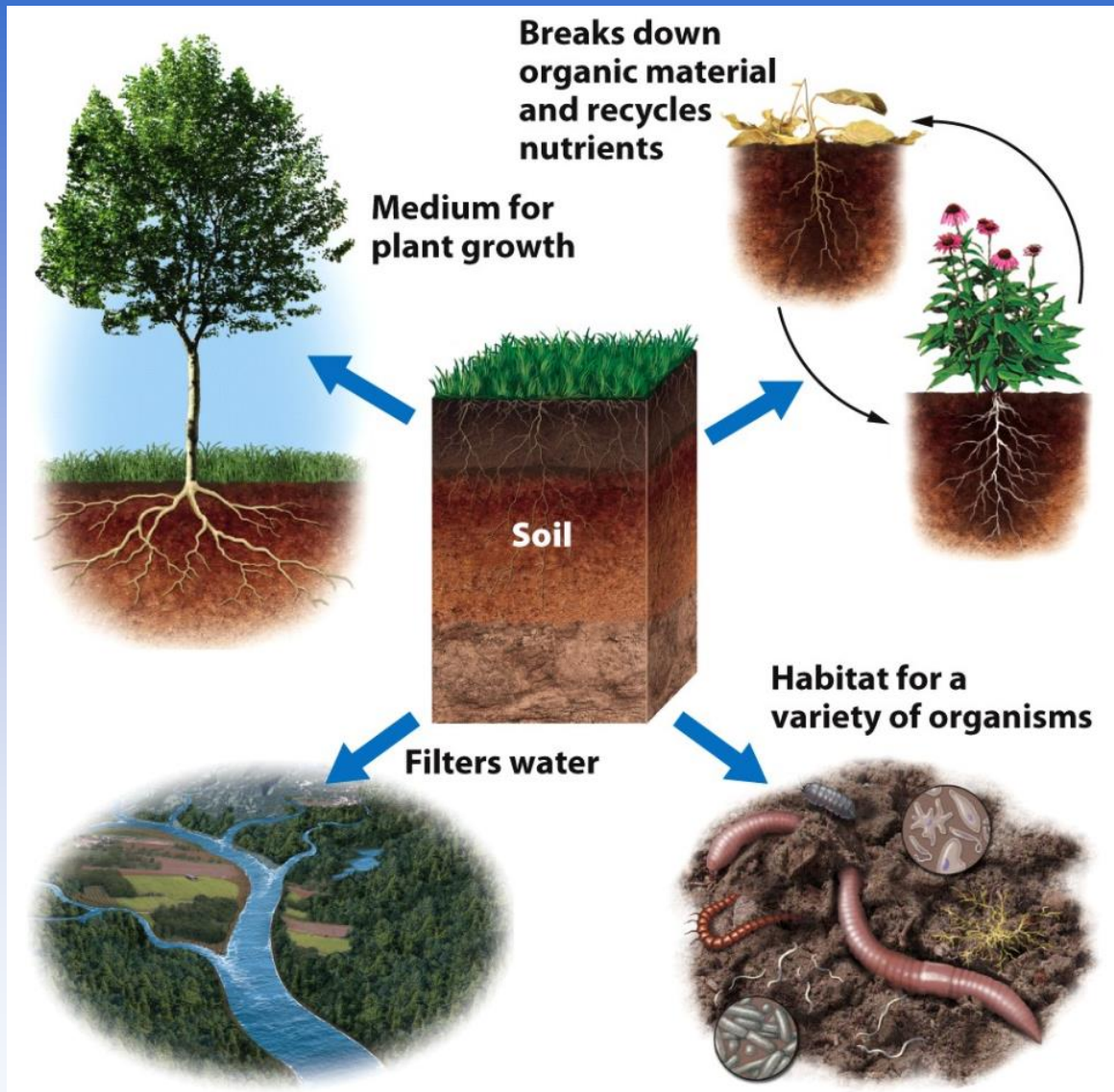


Figure 8.19
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Biological Properties of Soil

- Many **organisms are found in the soil** including fungi, bacteria, protozoans (all 3 together 90%), rodents and earthworms.

Majority of soil organisms are Detritivores.

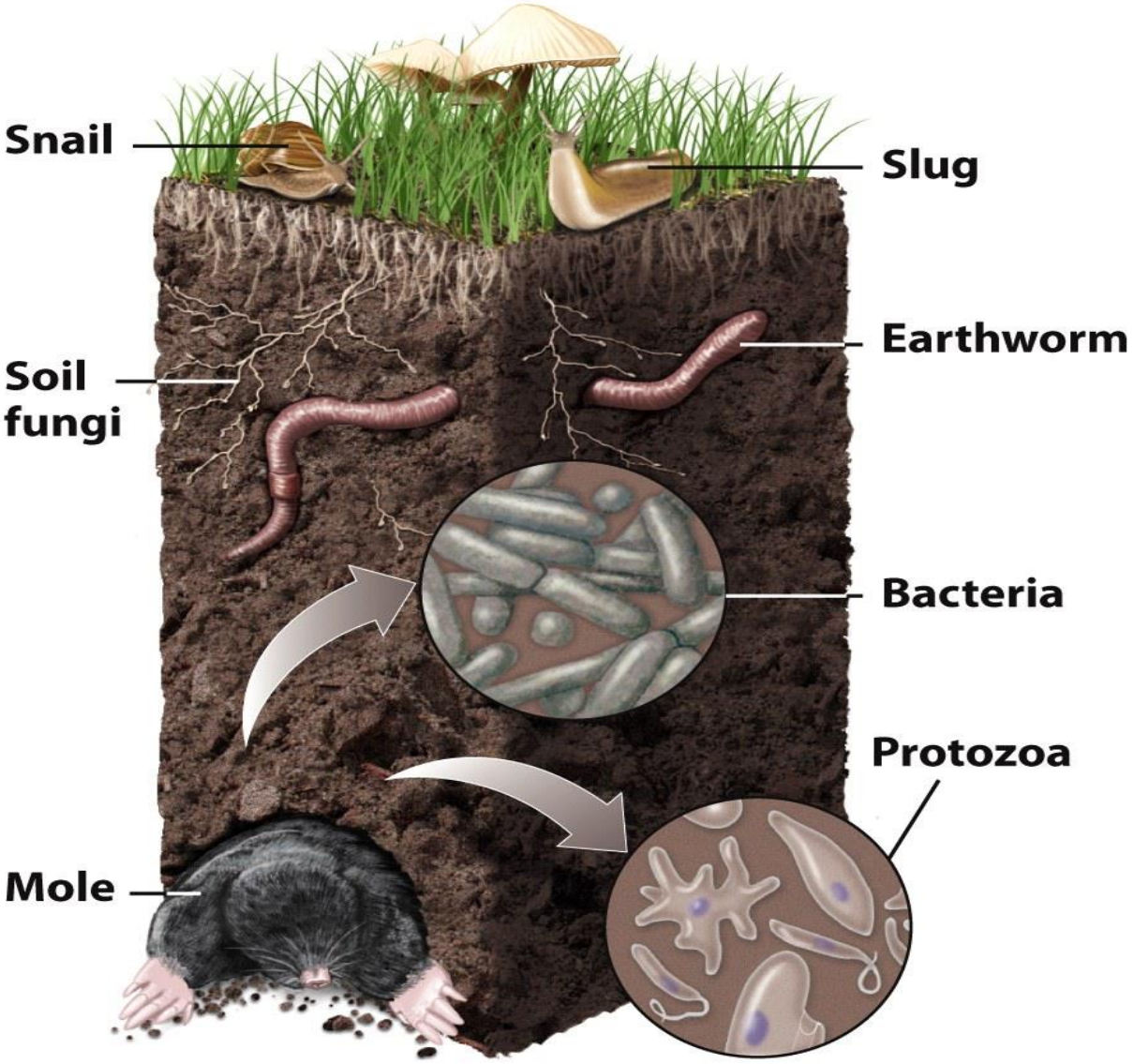

Figure 8.24
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Soil Horizons

- As soils form, they develop characteristics layers.
- If present...

E horizon- (zone of leaching or eluviation) forms under O or A horizon (less often), collects & transports (to B horizon) excess Fe, Al, & other organic acids

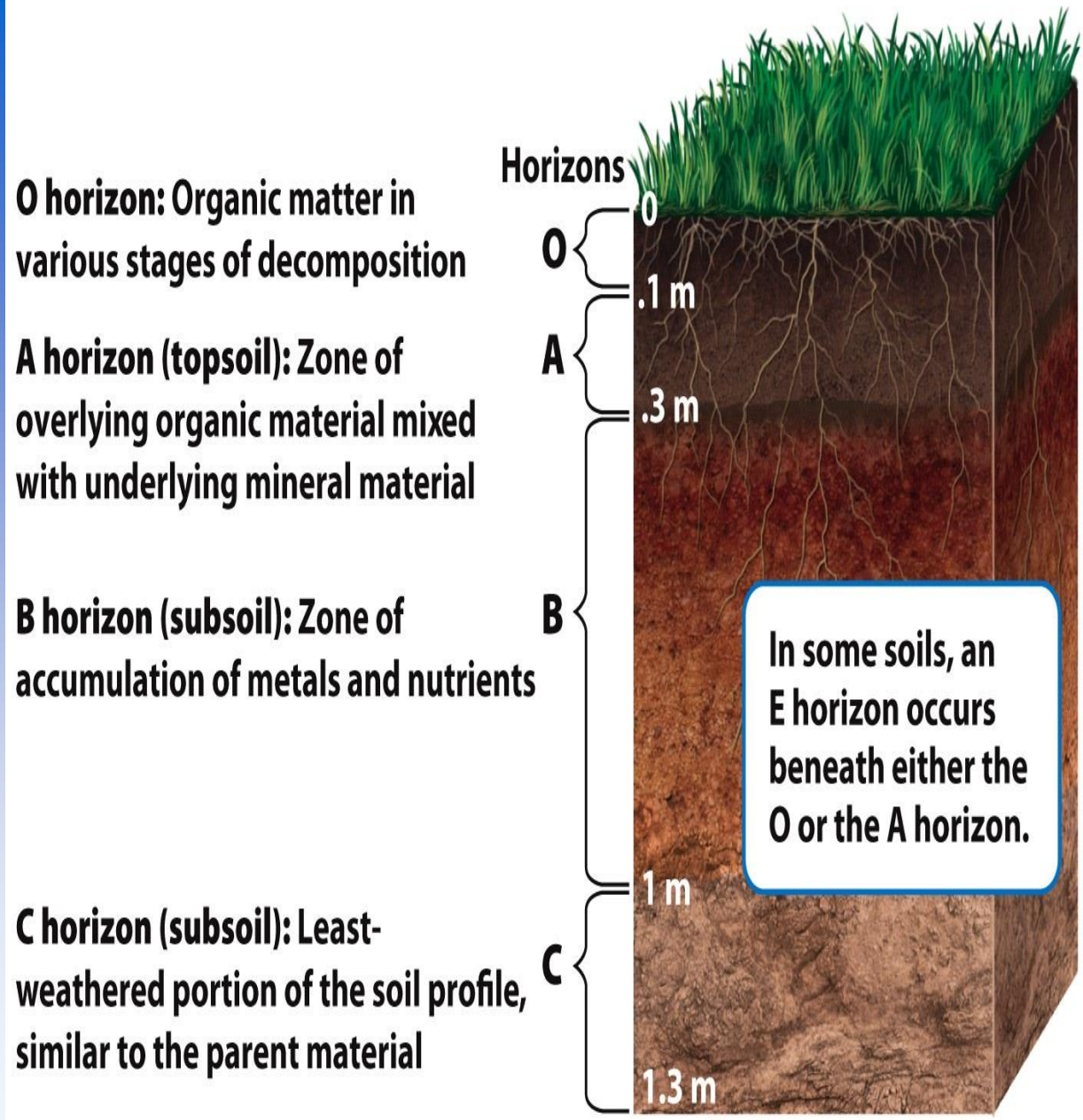

Figure 8.21
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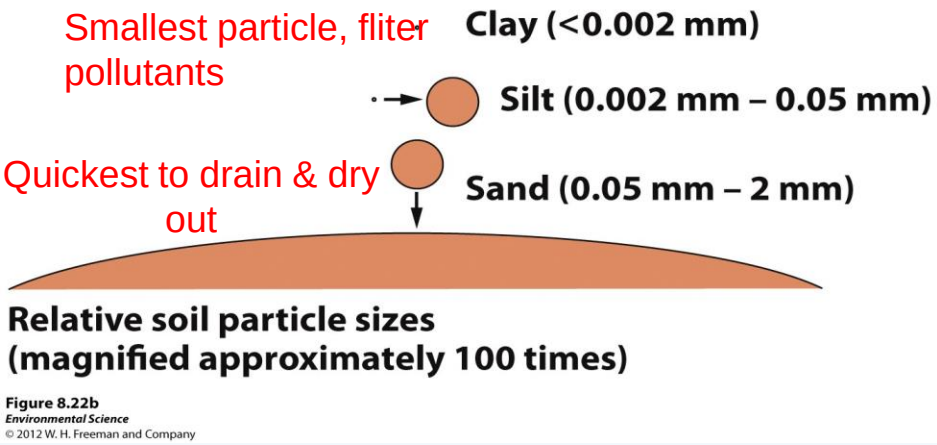
Physical Properties of Soil

- **Texture**- the percentage of *sand(40%), silt (40%) and clay (20%) the soil contains (LOAM).*
- *Porosity of soil* – how quickly soil drains.



Relative soil particle sizes (magnified approximately 100 times)

Figure 8.22b
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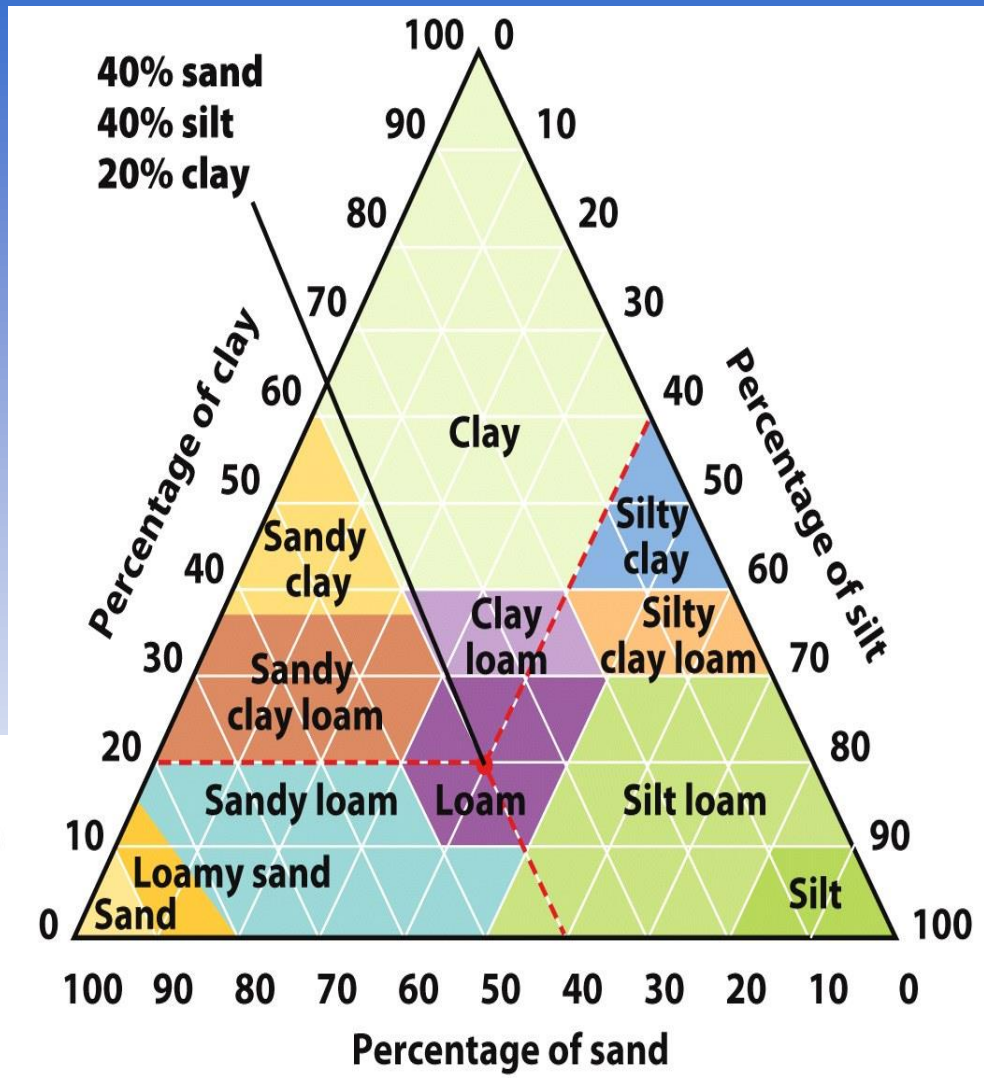

Soil texture chart

Figure 8.22a
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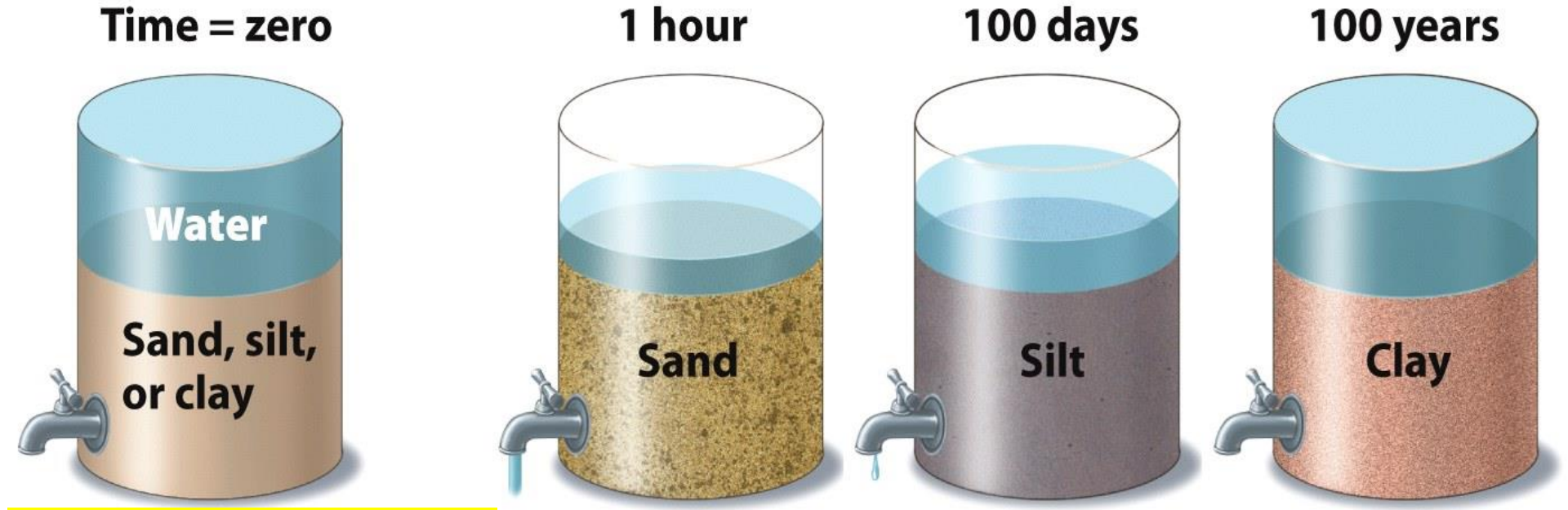
Physical Properties of Soil

- Porosity- how quickly the soil drains (which depends on its texture)



Ideal…balance mixture of sand (40%), silt (40%) and Clay(20%)for draining and

Loosely packed, lots of drainage of water

Intermediate in size and drainage of water

Less pore space, little/no drainage of water

- **Soil Degradation** – the loss of some or all of the ability of soils to support plant growth.

- One of the **major causes of soil degradation** is soil **erosion**, which occurs when topsoil is disturbed. (plowing, vegetation is removed, erosion by wind or water occurs).

- Once topsoil is lost, it may take up to centuries to replace it.

- Positive impacts of Mining 2 minutes
- Negative Impacts of Mining 3:53 minutes

Types of Mining

1. **Surface mining-** removing minerals or ore deposits that are close to Earth's surface.

Include…strip mining, open-pit mining (placer mining), mountaintop removal, dredging and highwall mining.

2. **Subsurface mining-** mining for resources that are 100 m below Earth's surface (use of tunnels and vertical shafts…**extraction of metal ore or fossil fuel resources**).

Include…solution mining, room and pillar, and longwall

*


Largest Open pit mining Kennecott Bingham
Canyon near Salt Lake City, Utah

Types of Mining

TABLE 8.2 Types of mining operations and their effects

Type of mining operation	Effects on air	Effects on water	Effects on soil	Effects on biodiversity	Effects on humans
Surface mining	Significant dust from earth-moving equipment	Contamination of water that percolates through tailings	Most soil removed from site; may be replaced if reclamation occurs	Habitat alteration and destruction over the surface areas that are mined	Minimal in the mining process, but air quality and water quality can be adversely affected near the mining operation
Subsurface mining	Minimal dust at the site, but emissions from fossil fuels used to power mining equipment can be significant	Acid mine drainage as well as contamination of water that percolates through tailings		Road construction to mines fragments habitat	Occupational hazards in mine; possibility of death or chronic respiratory diseases such as black lung disease

Table 8.2

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Mining Methods

Determined by the resource location and formation

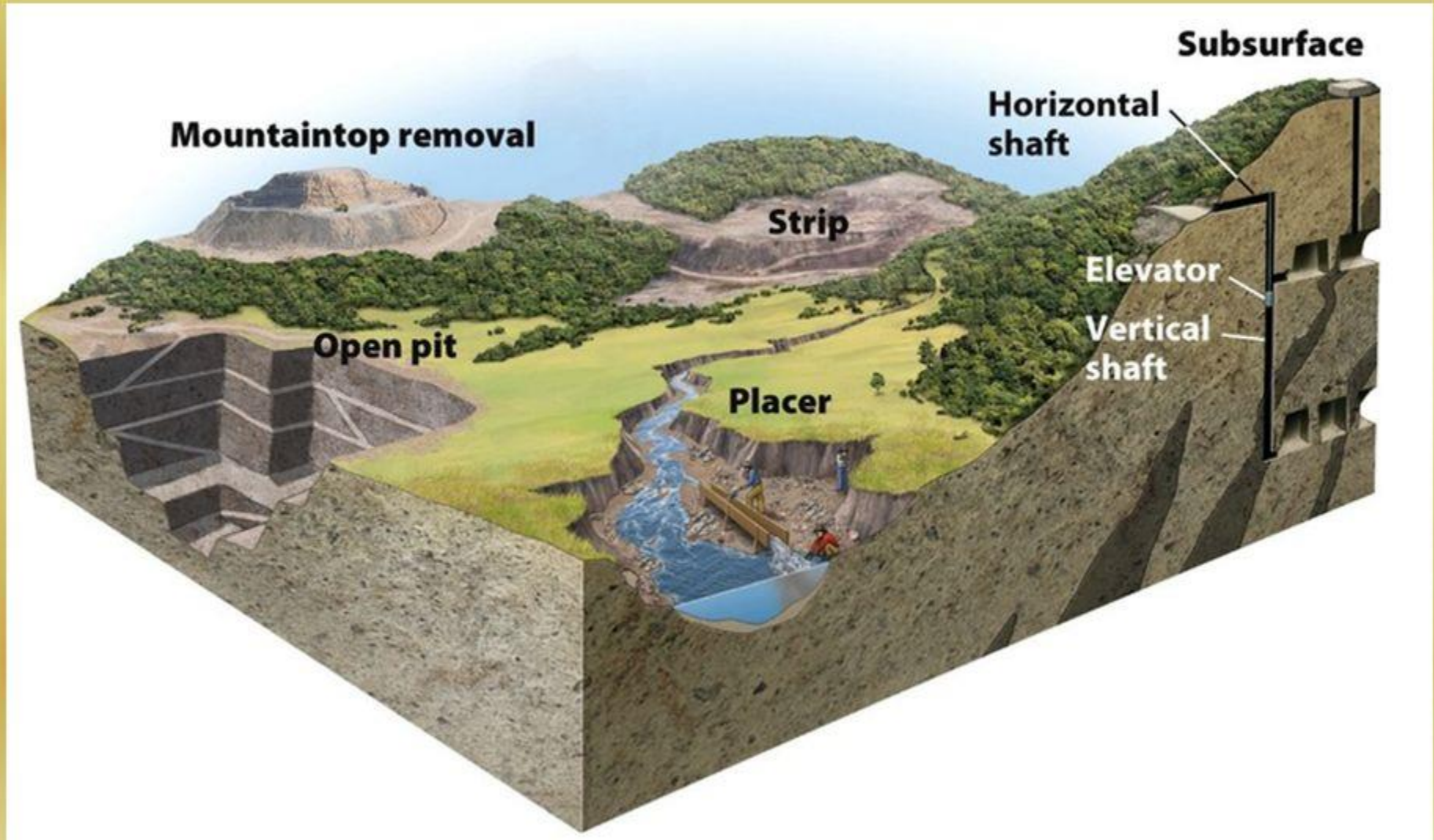
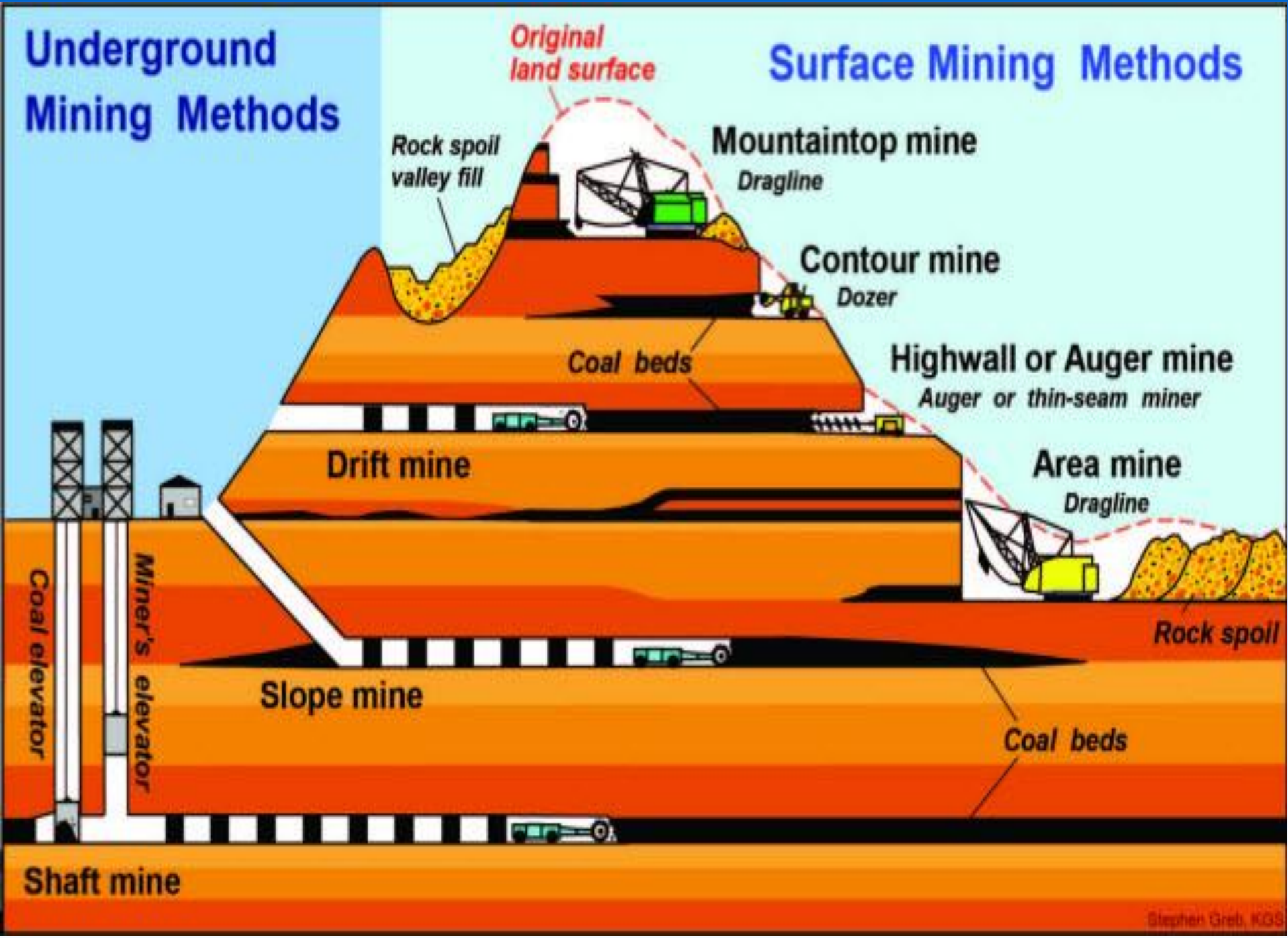


Figure 8.27 **Surface and subsurface mining.** Surface mining methods include strip, open pit, mountaintop removal, and placer mining.


Underground Mining Methods
Surface Mining Methods
Original land surface
Rock spoil valley fill
Mountaintop mine
Dragline
Contour mine
Dozer
Coal beds
Highwall or Auger mine
Auger or thin-seam miner
Drift mine
Area mine
Dragline
Coal elevator
Miner's elevator
Rock spoil
Slope mine
Coal beds
Shaft mine
Stephen Greb, KGS