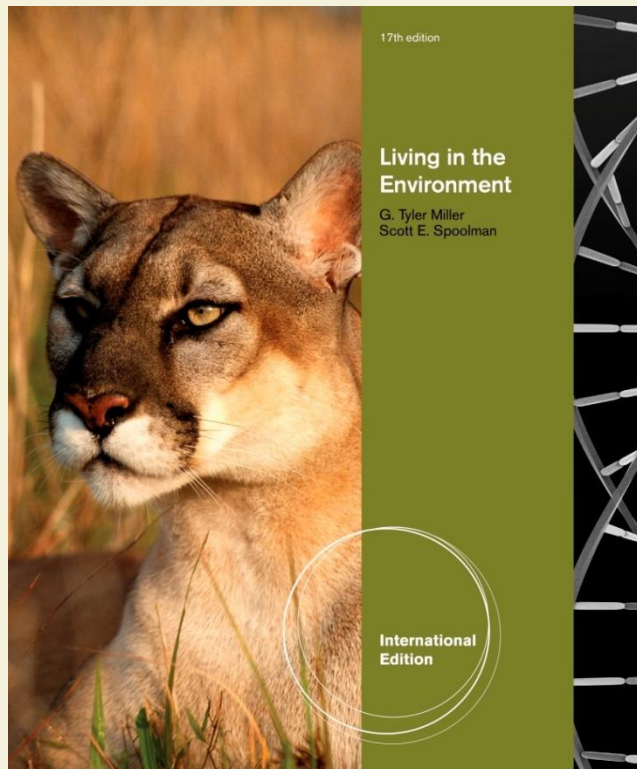


MILLER/SPOOLMAN

# LIVING IN THE ENVIRONMENT

17<sup>TH</sup>



## Chapter 14

### Geology and Nonrenewable Mineral Resources

# Core Case Study: The Real Cost of Gold

- Gold producers
  - China
  - South Africa
  - Australia
  - United States
  - Canada
- Cyanide heap leaching
  - Extremely toxic to birds and mammals
  - Spills contaminate drinking water and kill birds and fish

# Gold Mine with Cyanide Leach Piles and Ponds in South Dakota, U.S.



Fig. 14-1, p. 346

## *14-3 What Are Mineral Resources, and What Are their Environmental Effects?*

- **Concept 14-3** *We can make some minerals in the earth's crust into useful products, but extracting and using these resources can disturb the land, erode soils, produce large amounts of solid waste, and pollute the air, water, and soil.*

# We Use a Variety of Nonrenewable Mineral Resources (1)

- **Mineral resource**
  - Can be extracted from earth's crust and processed into raw materials and products at an affordable cost
  - Metallic minerals
  - Nonmetallic minerals
- **Ore**
  - Contains profitable concentration of a mineral
  - **High-grade ore**
  - **Low-grade ore**

# We Use a Variety of Nonrenewable Mineral Resources (2)

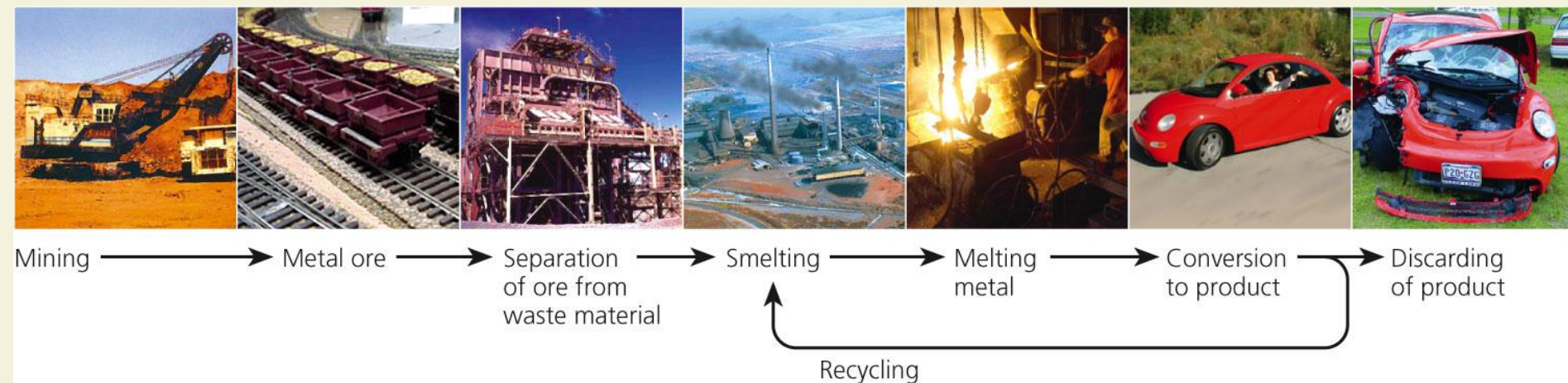
- Metallic mineral resources
  - Aluminum
  - Iron for steel
  - Copper
- Nonmetallic mineral resources
  - Sand, gravel, limestone
- **Reserves**: estimated supply of a mineral resource

# Some Environmental Impacts of Mineral Use

- Advantages of the processes of mining and converting minerals into useful products
- Disadvantages



# The Life Cycle of a Metal Resource





# Extracting, Processing, Using Nonrenewable Mineral and Energy Resources

## Natural Capital Degradation

### Extracting, Processing, and Using Nonrenewable Mineral and Energy Resources

#### Steps

##### Mining

Exploration, extraction



##### Processing

Transportation, purification, manufacturing



##### Use

Transportation or transmission to individual user, eventual use, and discarding



#### Environmental Effects

Disturbed land; mining accidents; health hazards; mine waste dumping; oil spills and blowouts; noise; ugliness; heat

Solid wastes; radioactive material; air, water, and soil pollution; noise; safety and health hazards; ugliness; heat

Noise; ugliness; thermal water pollution; pollution of air, water, and soil; solid and radioactive wastes; safety and health hazards; heat

# Natural Capital Degradation

## Extracting, Processing, and Using Nonrenewable Mineral and Energy Resources

### Steps

#### Mining

Exploration,  
extraction



#### Processing

Transportation,  
purification,  
manufacturing



#### Use

Transportation or  
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### Environmental Effects

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Solid wastes; radioactive  
material; air, water, and soil  
pollution; noise; safety and  
health hazards; ugliness;  
heat

Noise; ugliness; thermal water  
pollution; pollution of air,  
water, and soil; solid and  
radioactive wastes; safety and  
health hazards; heat

# There Are Several Ways to Remove Mineral Deposits (1)

- **Surface mining**
  - Shallow deposits removed
  - **Overburden** removed first
  - **Spoils**: waste material
- **Subsurface mining**
  - Deep deposits removed

# There Are Several Ways to Remove Mineral Deposits (2)

- Type of surface mining used depends on
  - Resource
  - Local topography
- Types of surface mining
  - **Open-pit mining**
  - **Strip mining**
  - **Contour strip mining**
  - **Mountaintop removal**
  -



# Natural Capital Degradation: Open-Pit Mine in Arizona



Fig. 14-13, p. 357



# Area Strip Mining in Wyoming



Fig. 14-14, p. 357

# Natural Capital Degradation: Contour Strip Mining

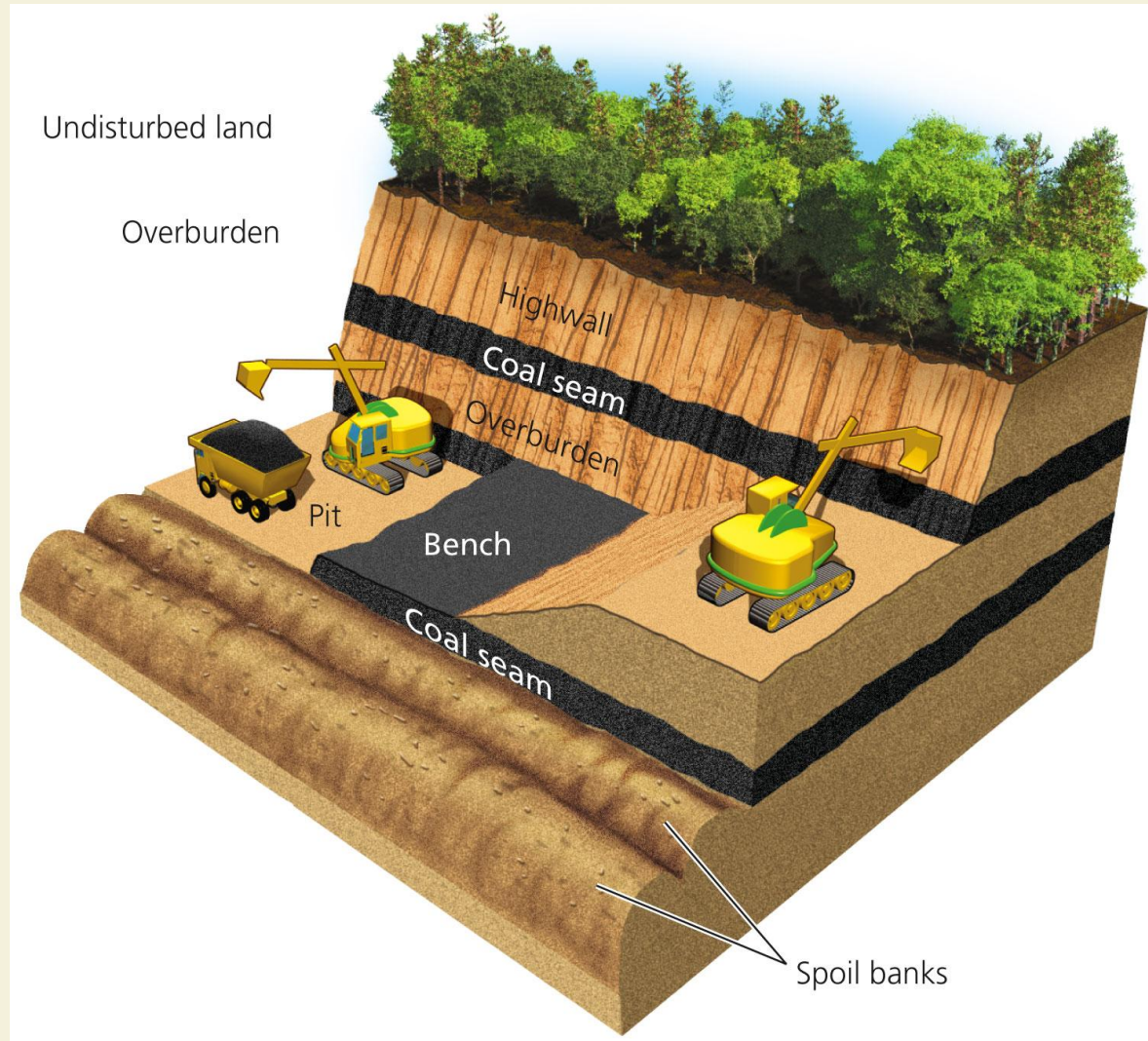
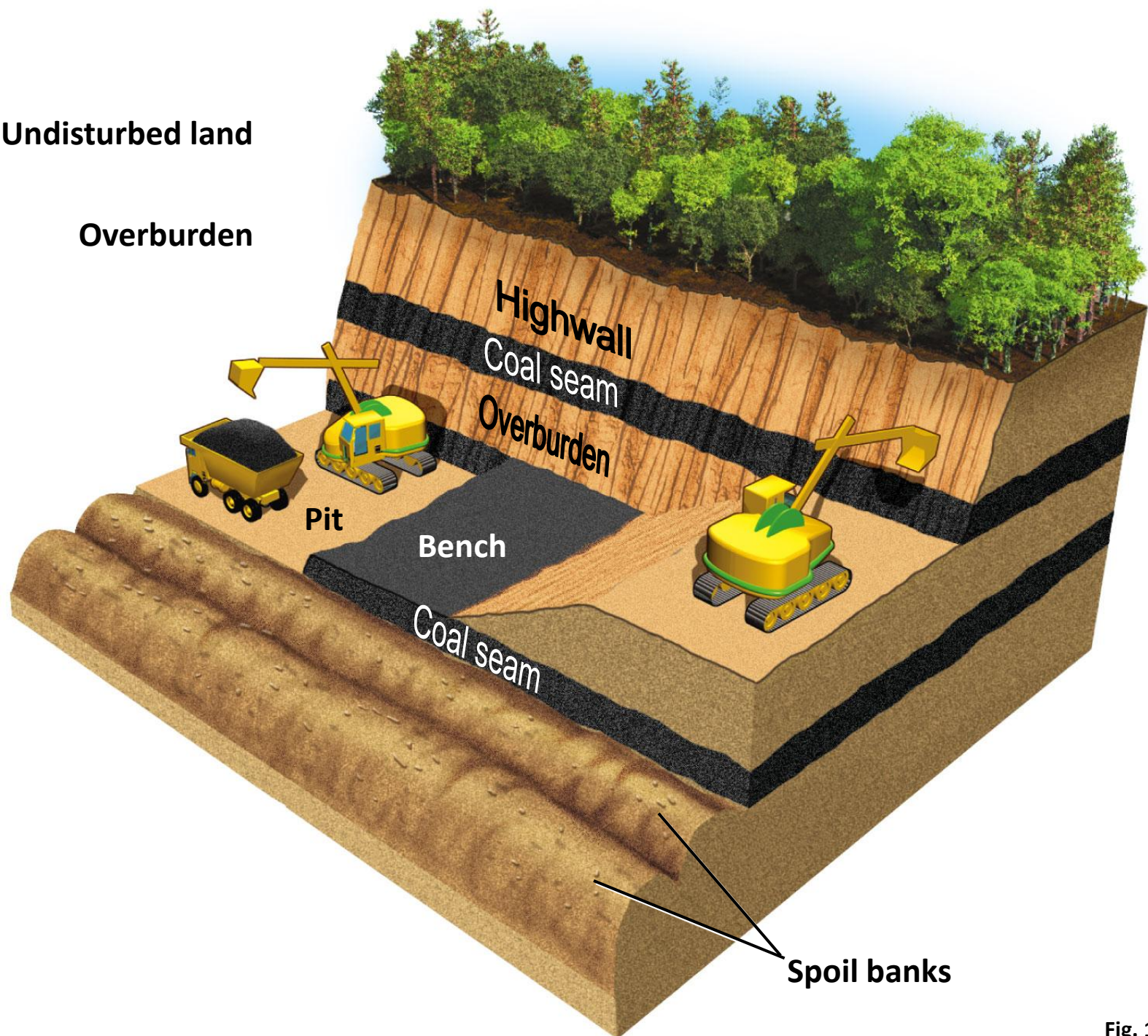


Fig. 14-15, p. 358



Undisturbed land

Overburden



Spoil banks

# Mining Has Harmful Environmental Effects (1)

- Scarring and disruption of the land surface
  - E.g., spoils banks
- Mountain top removal for coal
  - Loss of rivers and streams
  - Air pollution
  - Groundwater disruption
- Biodiversity decreased

# Mining Has Harmful Environmental Effects (2)

- Subsurface mining
  - Subsidence
  - Acid mine drainage
- Major pollution of water and air
- Effect on aquatic life
- Large amounts of solid waste



# Spoils Banks in Germany from Area Strip Mining



Fig. 14-16, p. 358

# Mountaintop Coal Mining in West Virginia



Fig. 14-17, p. 359



# Ecological Restoration of a Mining Site in Indonesia



Fig. 14-18, p. 360

# Removing Metals from Ores Has Harmful Environmental Effects (1)

- Ore extracted by mining
  - Ore mineral
  - Gangue = waste material
  - **Smelting** using heat or chemicals
- Air pollution
- Water pollution



# Removing Metals from Ores Has Harmful Environmental Effects (2)

- Liquid and solid hazardous wastes produced
- Use of cyanide salt to extract gold from its ore
  - Summitville gold mine: Colorado, U.S.