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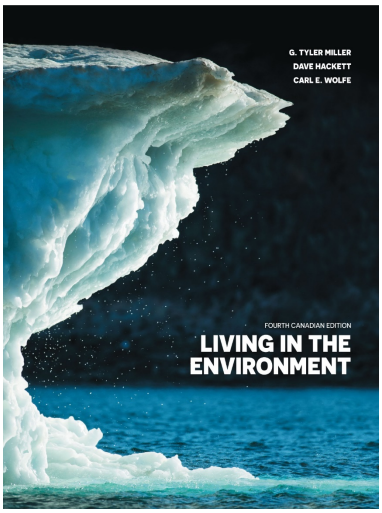
# NETA PowerPoint® Slides

to accompany




prepared by

Ian Dawe

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# Chapter 16

# Geology and Nonrenewable Mineral Resources

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## Key Concepts

Major geologic processes

Earthquakes and volcanoes

Minerals, rocks, and the rock cycle

Finding and extracting mineral resources

Nonrenewable mineral resources

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## Case Study: Diamonds of the North

Growing diamond industry
- 1998-2013: BHP in YT
- 2003: Diavik Diamonds in YT
- 2006: Jericho Diamond Project in NU
- 2011: Snap Lake, NWT, and Attawapiskat, ON
- 2016: Gahcho Kuè in NWT

Extensive environmental impact study

Governments and conservation groups watching closely

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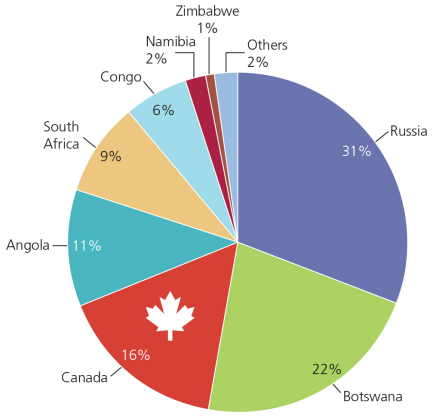
# Case Study: Diamonds of the North




Source: Data from USGS Mineral Commodity Summaries, 2015, http://minerals.usgs.gov/minerals/pubs/commodity/gemstones/mcs-2015-gemst.pdf

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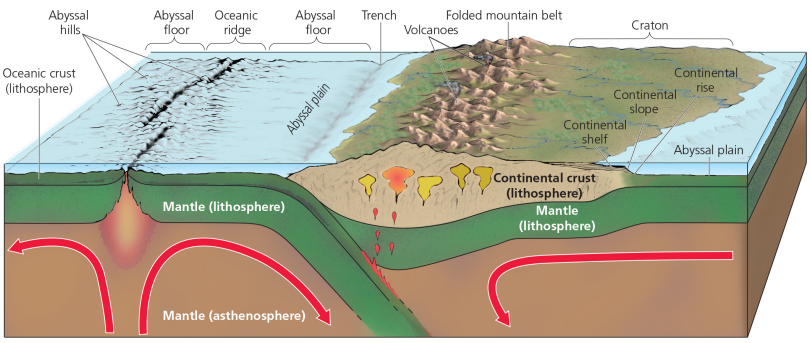
# Geologic Processes: What Is the Earth's Structure?

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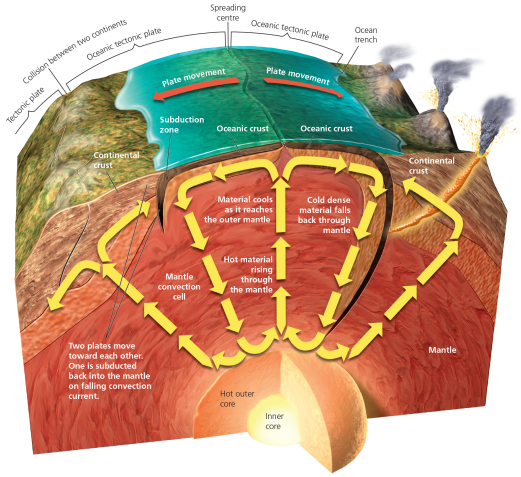
# Internal and External Geologic Processes

**Moving Tectonic Plates**

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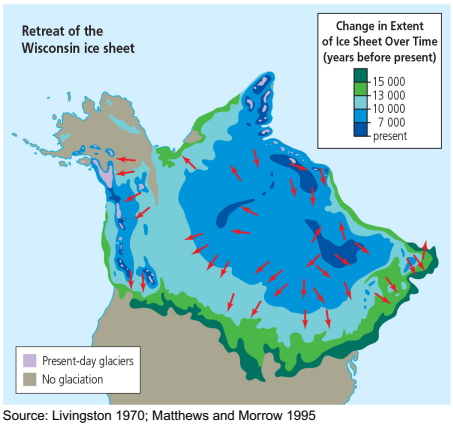
# Geologic Processes on the Earth's Surface

**Erosion**

**Glaciation**

**Weathering**

- Mechnanical
- Chemical
- Biological




Source: Livingston 1970; Matthews and Morrow 1995

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# Natural Geologic Hazards: Earthquakes

**Magnitude**

- Richter scale

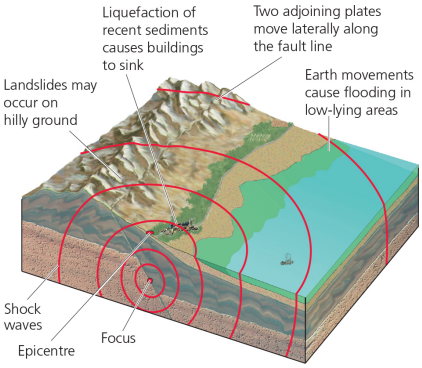
**Aftershocks and foreshocks**

**Primary effects**

- Ground displacement

**Secondary effects**

- Subsidence of land
- Tsunamis

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# Tsunamis

Can be caused by underwater earthquakes

Have caused significant damage in recent years

TABLE 16-1 **TSUNAMIS CAUSING SIGNIFICANT LOSS OF LIFE SINCE THE YEAR 2000**

The country indicated is where the tsunami originated. Deaths include all areas affected by the tsunami.

| Date | Country | Number of Deaths |
|---|---|---|
| March 2011 | Japan | 18 482 |
| October 2010 | Indonesia | 431 |
| February 2010 | Chile | 156 |
| September 2009 | Samoa | 192 |
| April 2007 | Solomon Islands | 52 |
| July 2006 | Indonesia | 802 |
| December 2004 | Indonesia | 227 899 |
| June 2001 | Peru | 26 |

Source: NOAA National Centers for Environmental Information

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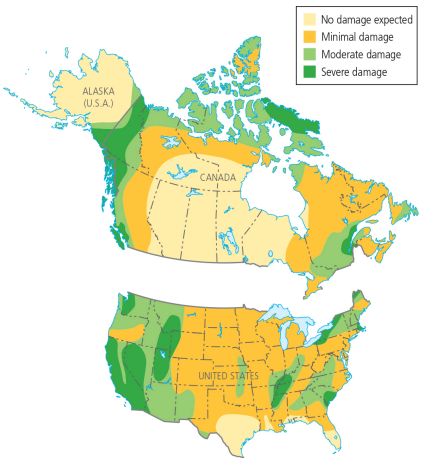
# Expected Damage from Earthquakes




Source: U.S. Geological Survey

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# Natural Geologic Hazards: Volcanic Eruptions

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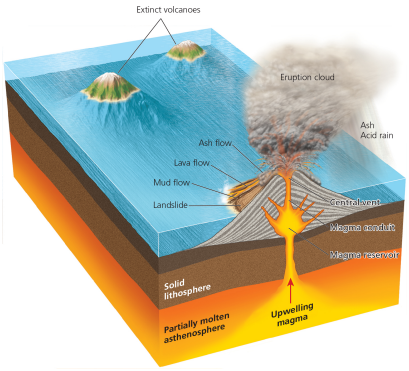


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# Minerals, Rocks, and the Rock Cycle

## Minerals

– Inorganic elements or compounds with regular crystal structure

## Rock

– Solid combination of 1+ minerals in the crust

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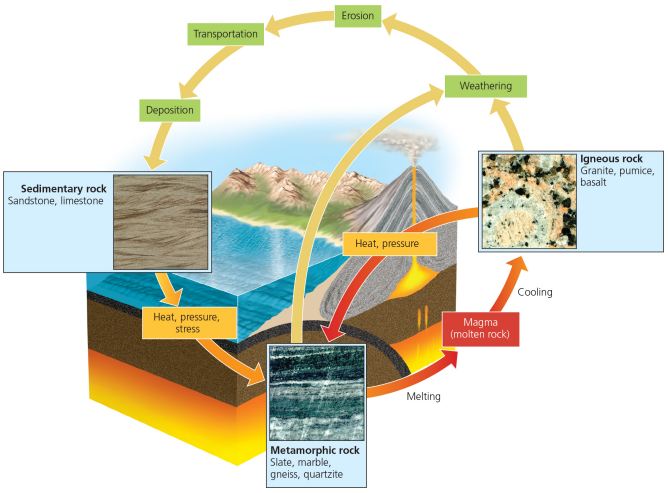
# The Rock Cycle

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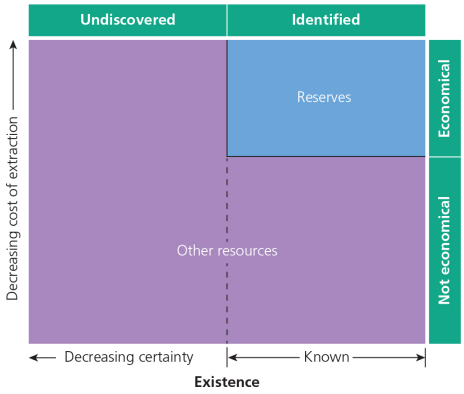
# What Are Nonrenewable Mineral Resources?

**Mineral Types**

- Metallic
- Nonmetallic
- Energy

**Ores**

- Rocks with mining profit

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# How Are Buried Mineral Deposits Found?

- Satellite and air imagery
- Radiation detectors
- Magnetometers
- Gravity differences
- Seismic surveys
- Chemical analyses

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# How Are Buried Mineral Deposits Removed?

**Surface mining**
- Strip the overburden and discard as spoils
- Methods: Open-pit
  Dredging
  Area strip
  Contour strip
  Mountaintop removal

**Subsurface mining**
- Less land disruption but higher worker risk

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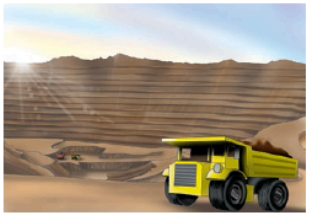
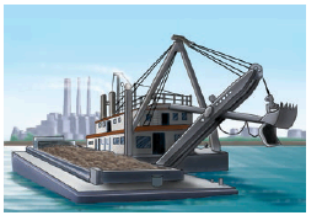
# Removing Surface Mineral Deposits


(a) Open-Pit Mine


(b) Dredging


(c) Area Strip Mining


(d) Contour Strip Mining

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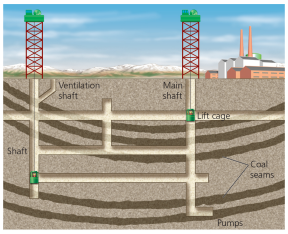
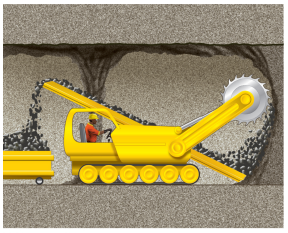
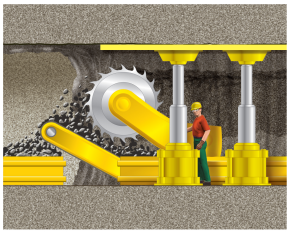
# Removing Buried Mineral Resources



(a) Underground Coal Mine


(b) Room-and-Pillar


(c) Longwall Mining of Coal

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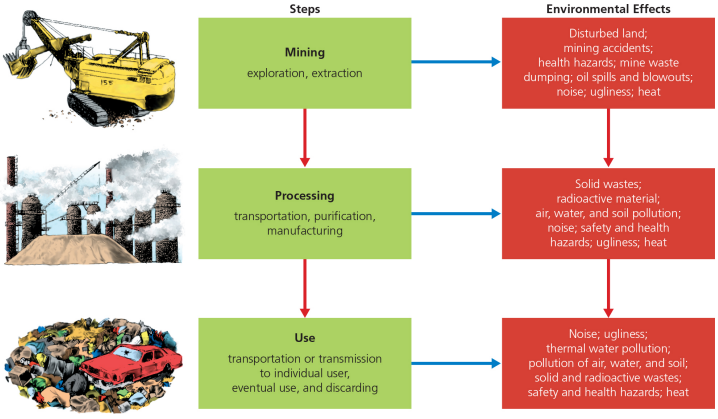
# Environmental Impacts of Nonrenewable Resources

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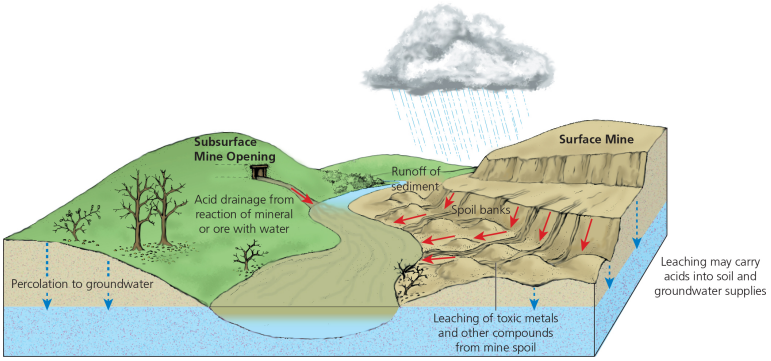
# Environmental Impacts of Extracting Nonrenewable Mineral Resources

- **Acid mine drainage**

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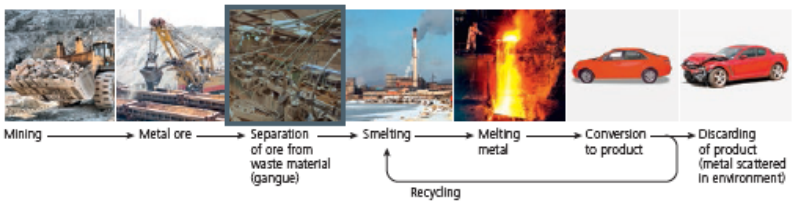
# Life Cycle of a Metal Resource

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# Supplies of Mineral Resources in Canada

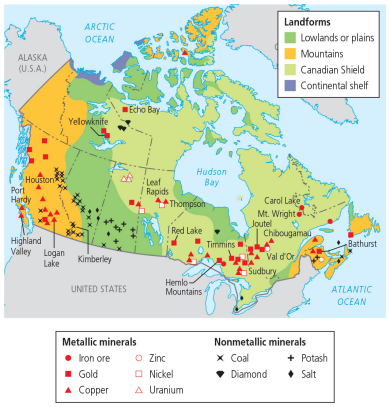
Wide distribution

150+ communities dependent on mining

Historical impact

– Klondike gold rush

Negative impacts mining industry must be addressed




Source: Matthews and Morrow, 1995; Diamonds North Resources Ltd.

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# Spotlight: Potentially Conflicting Uses of the Niagara Escarpment

Conflict over use of Niagara Escarpment

– World biosphere reserve (UNESCO)
– Lucrative source of sedimentary rocks
– Housing development
– Wind power development

Canada's first large-scale environmental land-use plan

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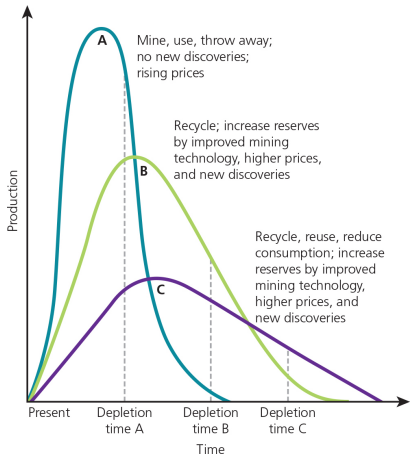
## Supplies of Mineral Resources in Canada: Will We Have Enough in the Future?




- Depletion time
- Reserves depend on available technology
- Rate of use depends on price, applications, available substitutes

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## Conclusion

- Due to plate tectonics (and other factors), the earth has many mineral resources.
- Earthquakes and other geology-based disasters sometimes occur.
- Surface and mineral resources
- Environmental effects of extraction need to be managed.

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