Geology and Mining
1. Case Study: Coltan
2. Geology
3. Mining
Case Study: Coltan

• Democratic Republic of Congo (DRC)
  – Since 1998 numerous wars and smaller conflicts
  – Rich natural resources
    • Gold
    • Tantalum (“Coltan”)
    • Tin
    • Tungsten
Case Study: Coltan

- Local miners exploited
  - Corrupt politicians (taxes, etc.)
  - Rebel/military leaders
  - Trans-national corporations
- Changes in global supply/demand also have worsened situation
1. Case Study: Coltan

• “Resource curse”
  – Countries rich in natural resources but economically poor
    • Profits go to few
    • Average citizen has low quality of life
  – Most deaths from starvation or disease
2. Geology

- Recall from earlier the parts of the environment
  - Lithosphere
  - Atmosphere
  - Hydrosphere

- Geology: the study of Earth’s lithosphere
2. The Rock Cycle

- **Magma and lava**
  - Melting
  - Cooling and crystallization

- **(a) Igneous rock**
  - Weathering, erosion, transport, deposition

- **(c) Metamorphic rock**
  - Heating and pressure

- **(b) Sedimentary rock**
  - Weathering, erosion, transport, deposition
  - Lithification

- **Sediments**
  - Weathering, erosion, transport, deposition

Figure 11.4
Geology

- Plate tectonics
  - Movement of sections of lithosphere
  - Three possibilities
    - Divergent
    - Transform
    - Convergent

Continental Drift

www.geol.umd.edu
2.

Figure 11.3

(a) Divergent plate boundary
(b) Transform plate boundary
(c) Convergent plate boundary
Figures 11.5, 11.7, 11.8, 11.9
3.

“If it can’t be grown, it must be mined”
3. **Mining**

- **Steps in mining**
  - **Exploration**
    - Rock formations likely to have resource
    - Feasibility studies
  - **Extraction**
    - Building necessary infrastructure
    - Collecting parent material
  - **Processing**
    - Separating resource from rock and soil
    - Smelting and/or purifying
Mountaintop Removal

(a) Tantalite ore

(b) Purified tantalum

(c) Capacitor containing tantalum

Withgott and Laposata 2012
Mining

- An oft-neglected step
  - Mine reclamation
    - An attempt to return a mined area to its previous ecological state
    - Includes cleanup of mine leftovers
      - Tailings
      - Acid drainage

Figure 11.14

Withgott and Laposata 2012
Mining

• Thinking about “cradle to grave”
  – Many mined resources are wasted
    • Engineered obsolescence
    • Changes in technology
    • Consumer demand for “new”

– Downside
  • Increased cost as resource becomes scarce
  • Increased environmental hazards

Superfund
3. **Mining**

- **Recycling**
  - Decreases waste of nonrenewable resources
  - Upcycling vs. downcycling
  - Common for expensive materials
    - E.g., aluminum, copper
    - Raw aluminum requires 20x the energy of recycled aluminum
Mining

• Recycling cont’d
  – Not as encouraged for items that create environmental harm
    • E.g., cell phones
      – Heavy metals
      – Flame retardants
      – Various plastics
    • Only about 10% are recycled

The Story of Electronics
Resources

Publications