

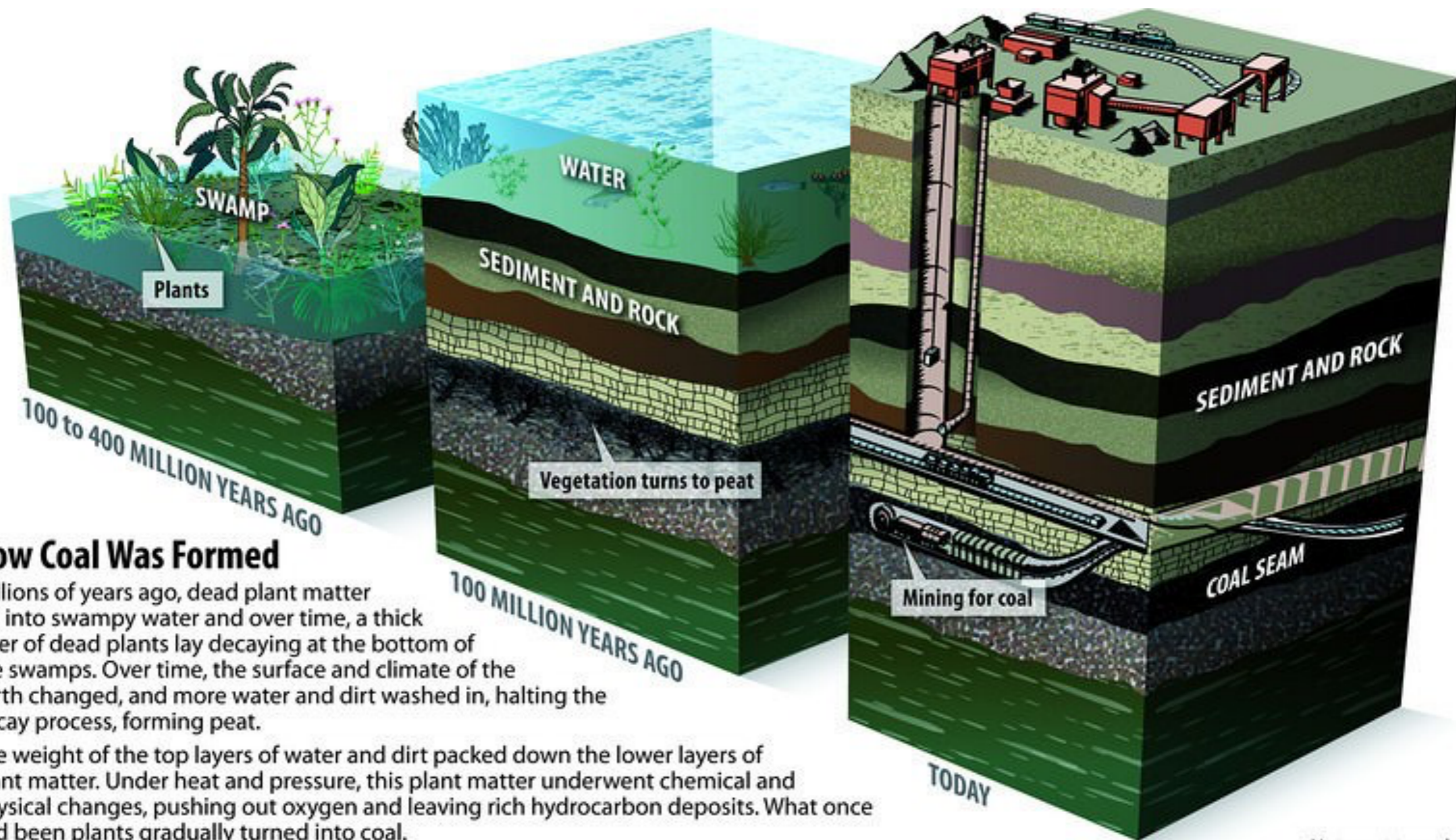
# UNIT 4 SG 4

.....  
*Resource Management - Land*



# **I. NONRENEWABLE RESOURCES**

- **A. Fossil Fuels include coal, petroleum (oil), and natural gas.**
- **1. Fossil fuels, when combusted, free up energy from the Sun that was stored in plants & animals that died millions of years ago.**



## How Coal Was Formed

Millions of years ago, dead plant matter fell into swampy water and over time, a thick layer of dead plants lay decaying at the bottom of the swamps. Over time, the surface and climate of the Earth changed, and more water and dirt washed in, halting the decay process, forming peat.

The weight of the top layers of water and dirt packed down the lower layers of plant matter. Under heat and pressure, this plant matter underwent chemical and physical changes, pushing out oxygen and leaving rich hydrocarbon deposits. What once had been plants gradually turned into coal.

Coal can be found deep underground (as shown in this graphic), or it can be found near the surface.

Note: not to scale

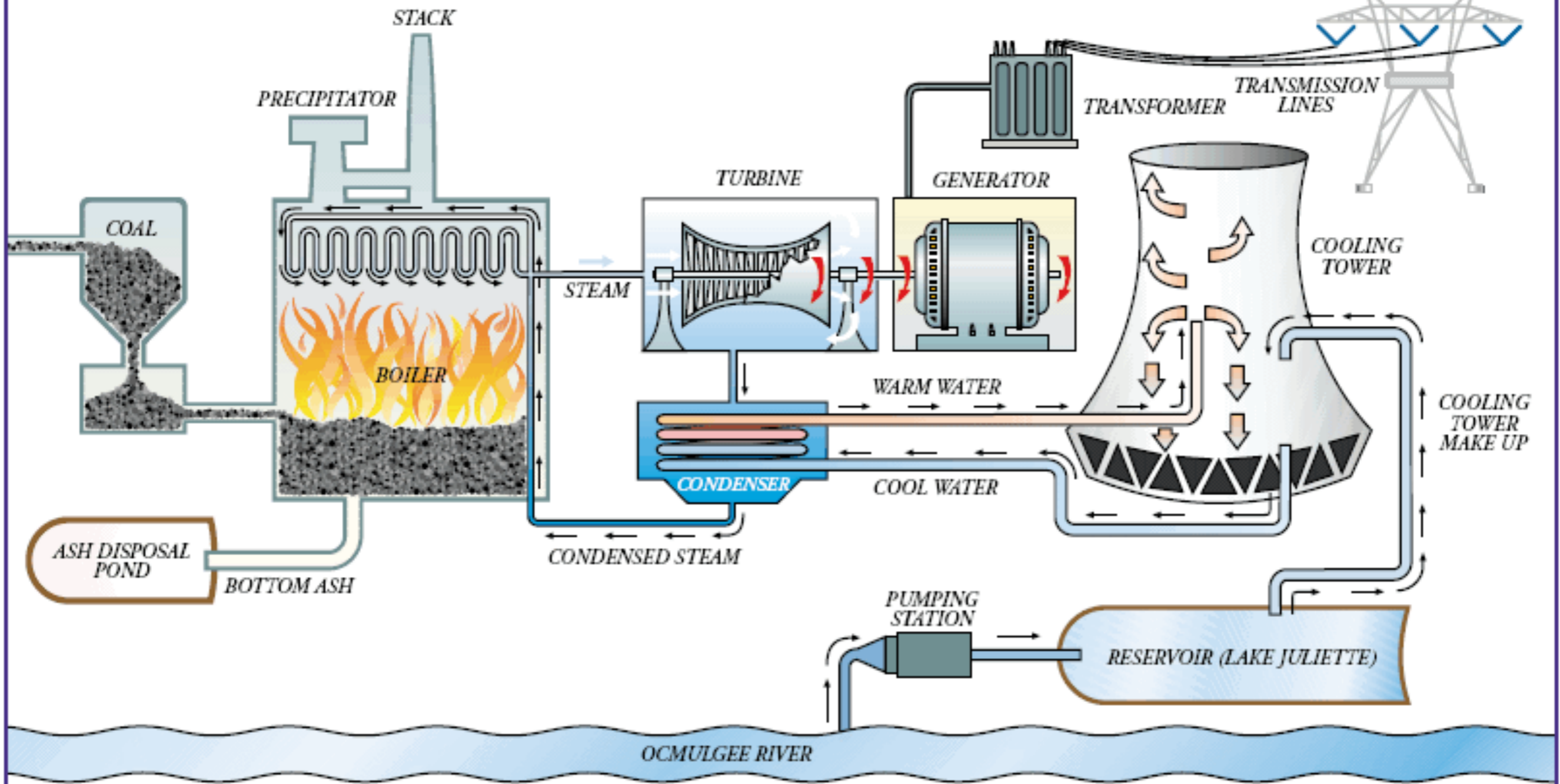
- B. Coal is the major fuel used in power plants to generate electricity.
  - 1. It is used to heat water into steam, that turns a turbine, that turns an [electric generator](#).
  - 2. Problems with coal use include environmental damage from mining and air pollution from burning it.



# *Coal Mountaintop Strip Mining*

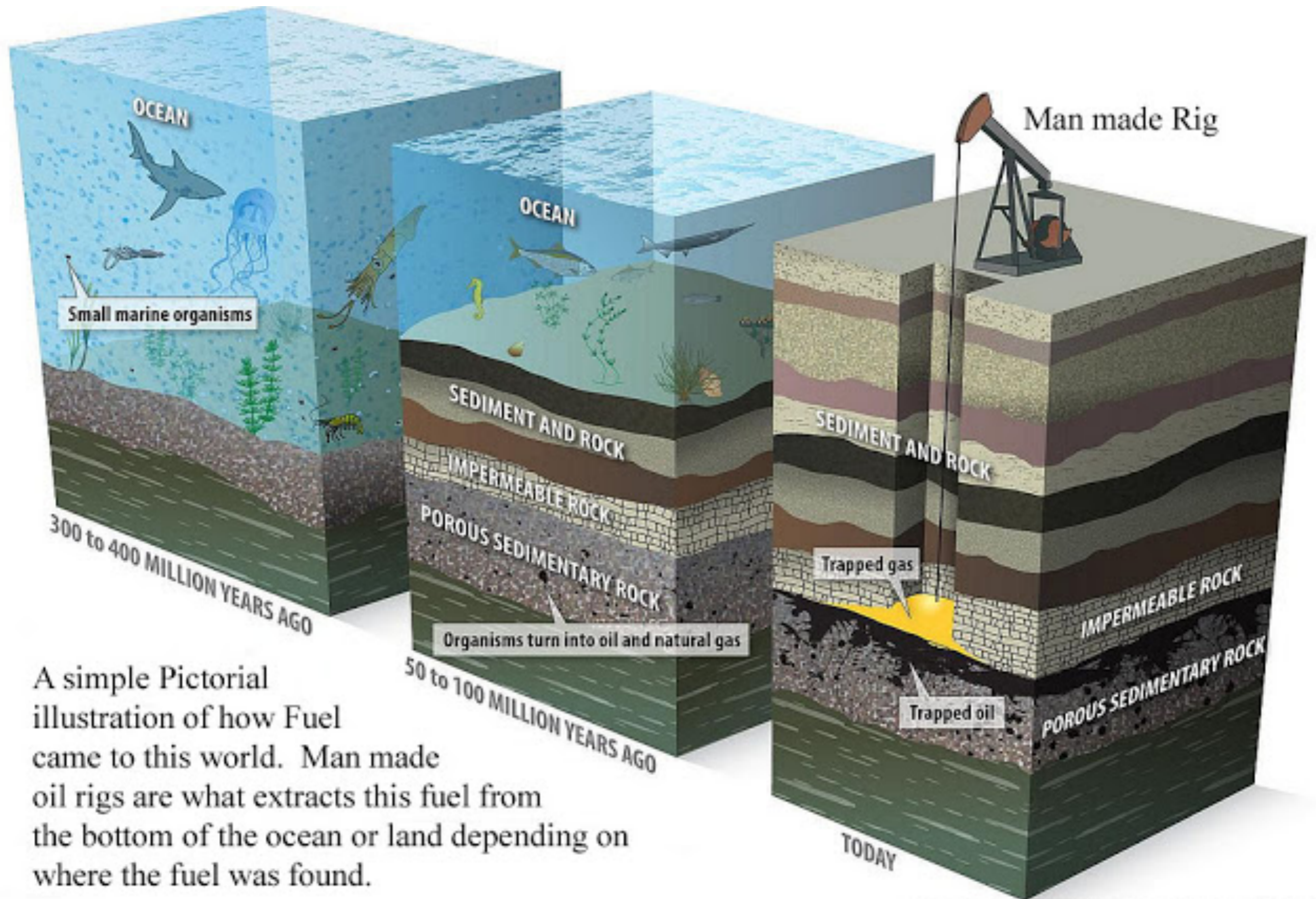


# Plant Scherer, Georgia



Credit: Georgia Power

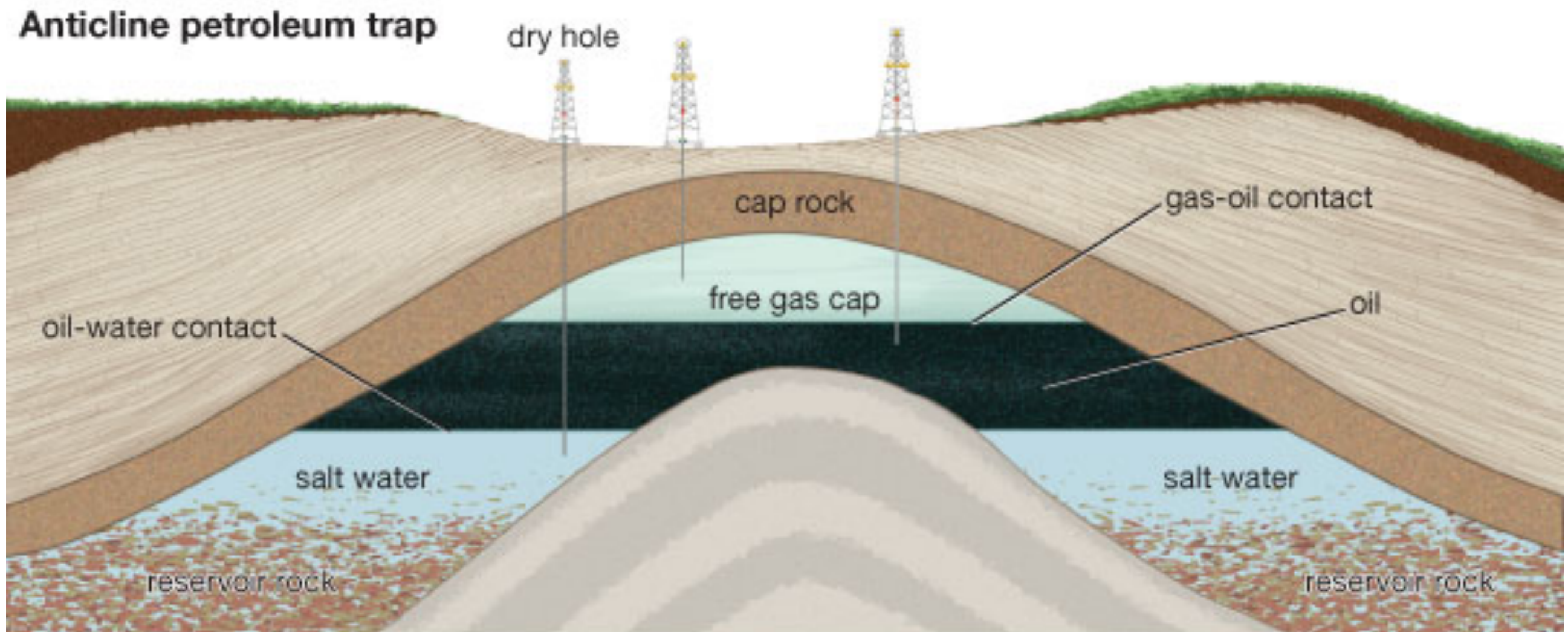
- **C. Oil and Natural Gas**
- **1. Petroleum formation begins with the burial of large quantities of organic material**
  - **a. Both oil and natural gas consist of hydrocarbon compounds and are found in similar environments**
  - **b. Organic material is transformed to liquid and gaseous hydrocarbons through chemical reactions with increasing burial over millions of years**
  - **c. Liquids and gases migrate into permeable beds**
- **2. Usage in the U.S. - Combined, provide more than 60 percent of the energy consumed in the United States**
  - **a. In 2011, natural gas production exceeded coal production for the first time in 30 years**



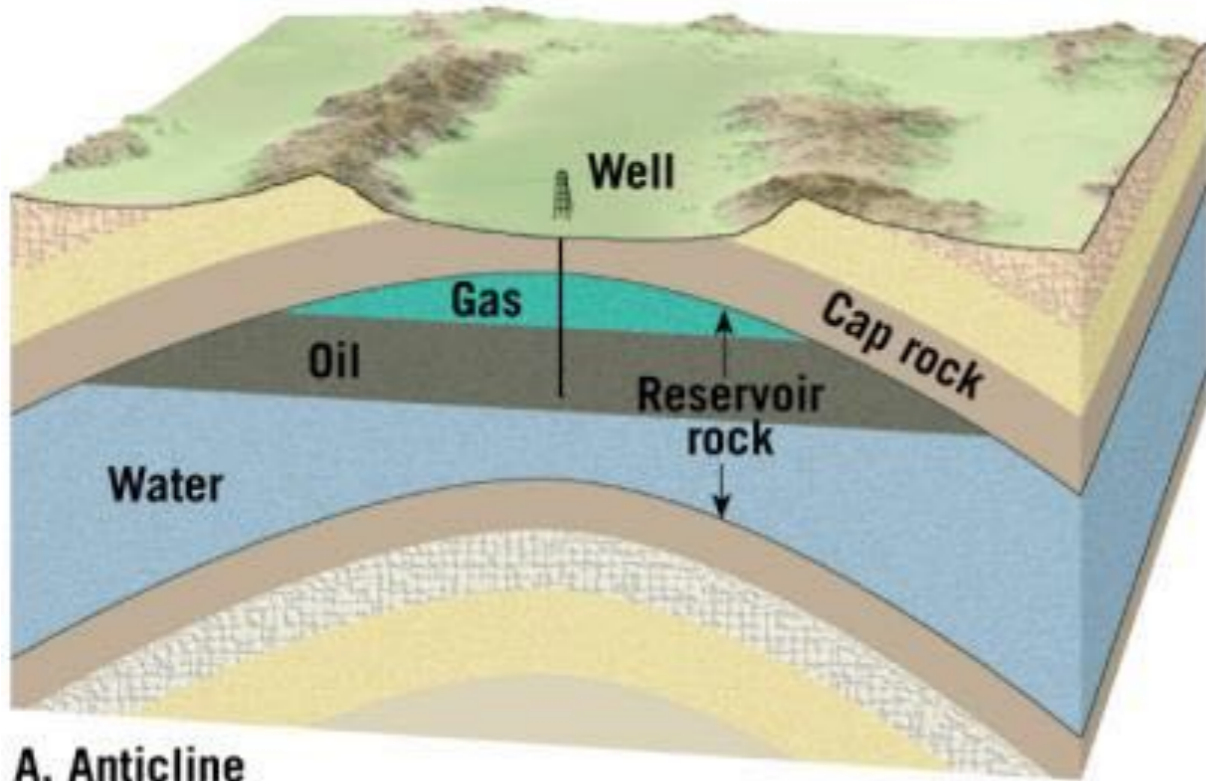
A simple Pictorial illustration of how Fuel came to this world. Man made oil rigs are what extracts this fuel from the bottom of the ocean or land depending on where the fuel was found.



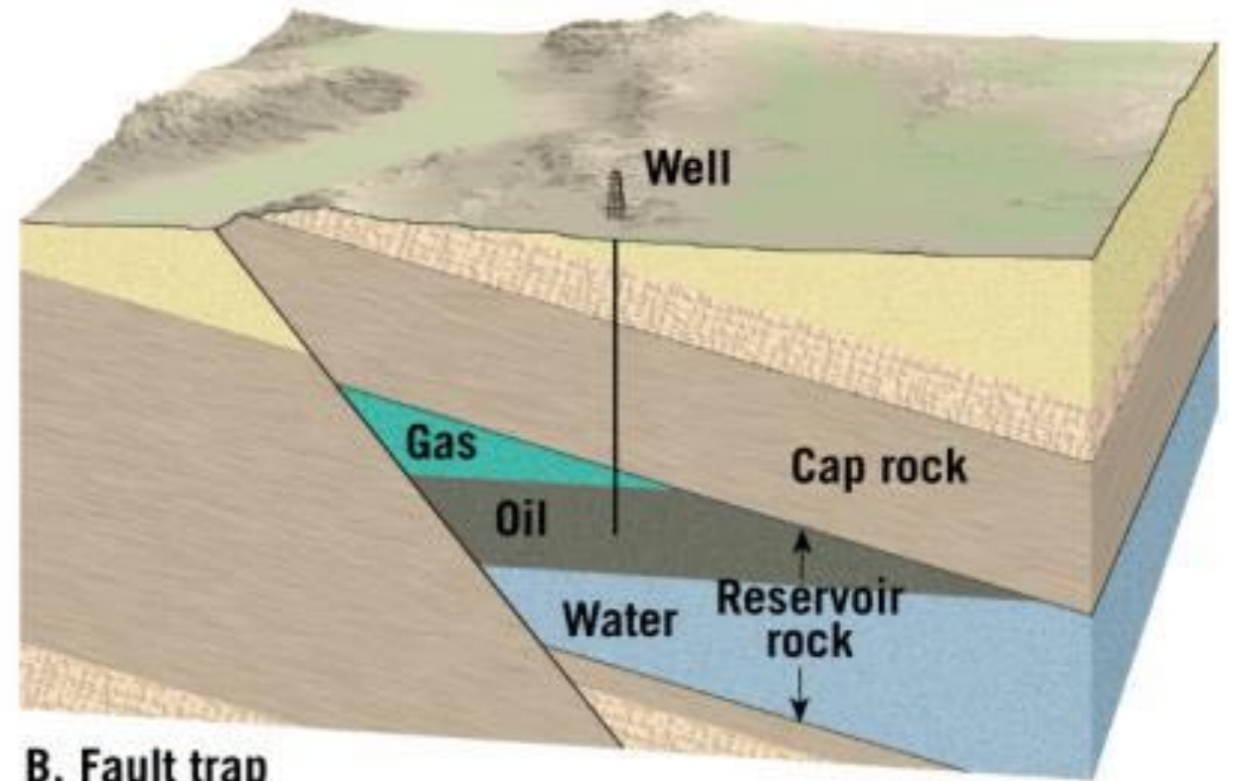
- D. Where Oil & Gas Are Found
  - 1. An oil trap is an environment that allows for economically significant amounts of oil and gas to accumulate underground.
    - a. We tap into these reservoirs and pump oil and gas to the surface.



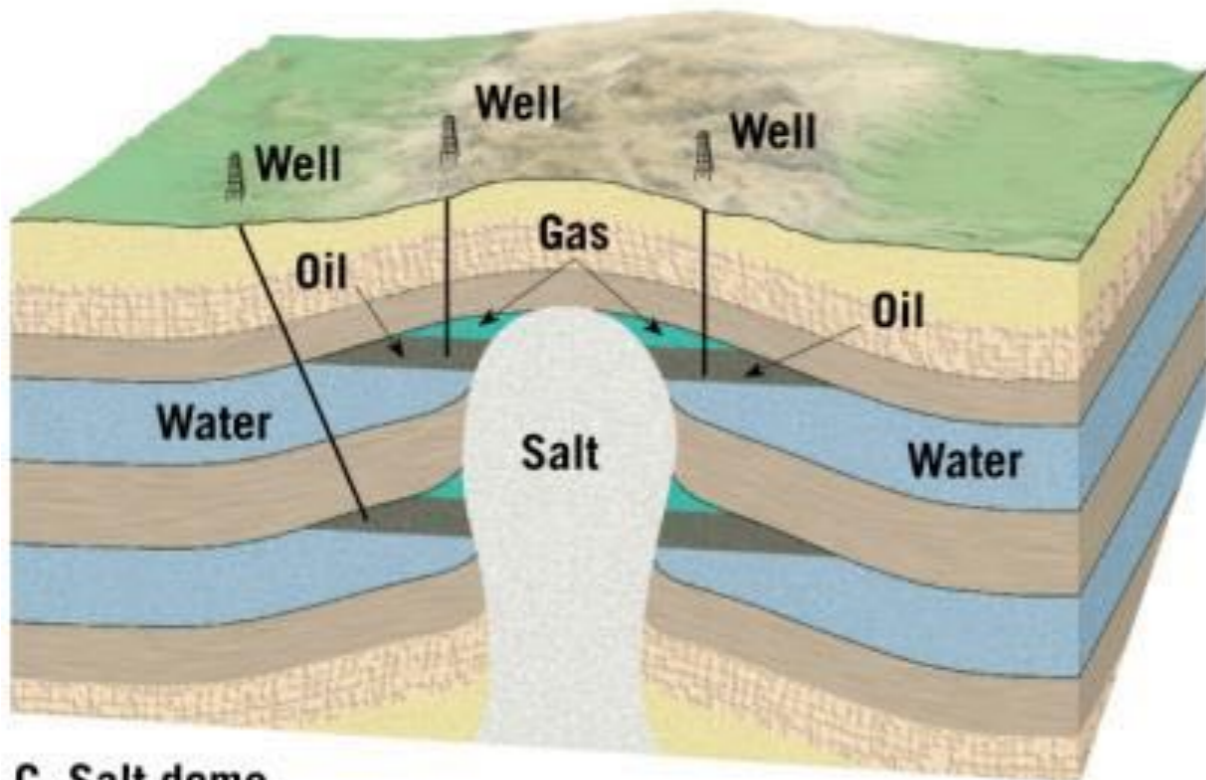
# How Oil & Natural Gas Are Formed



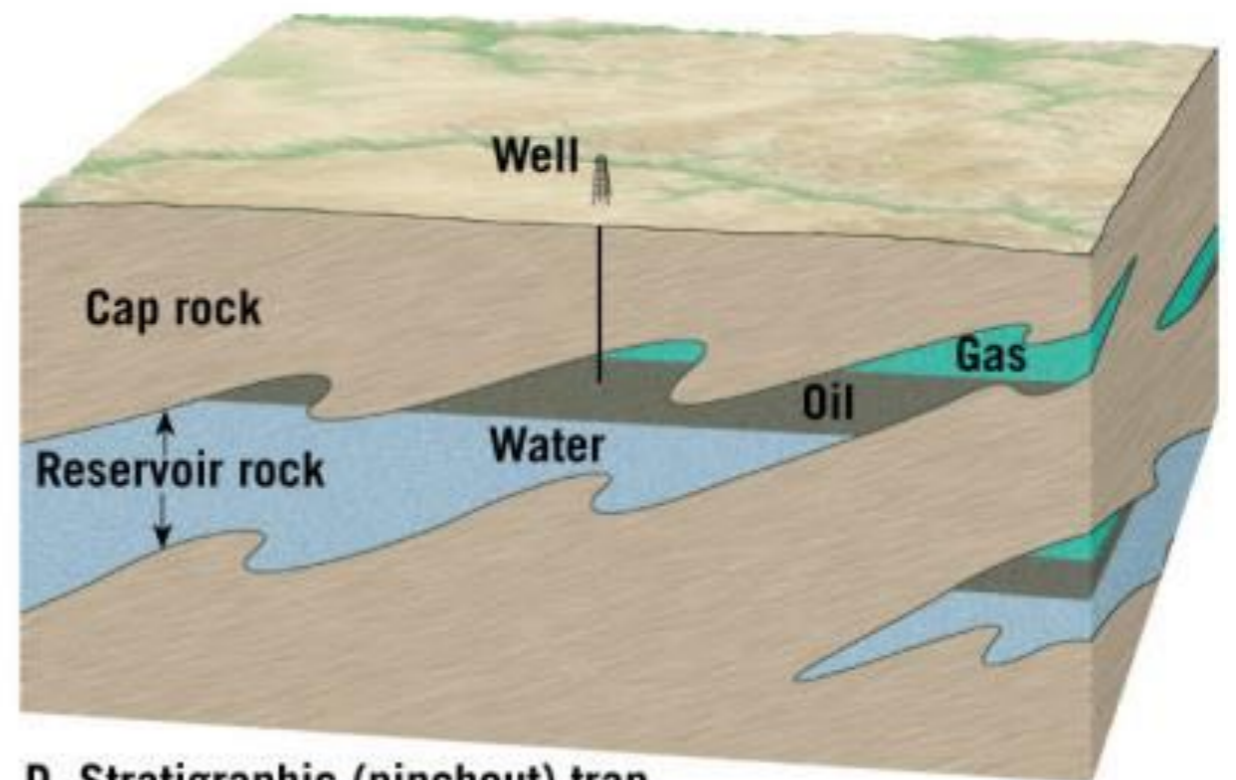
A. Anticline



B. Fault trap

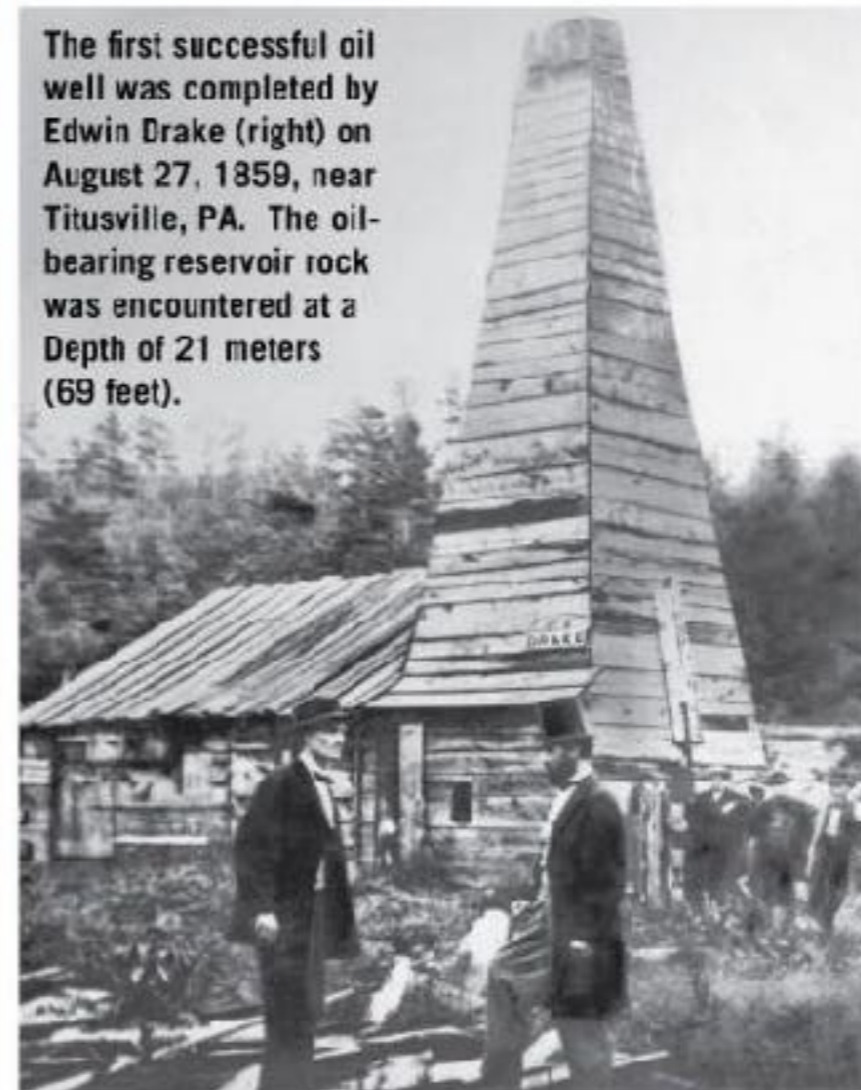
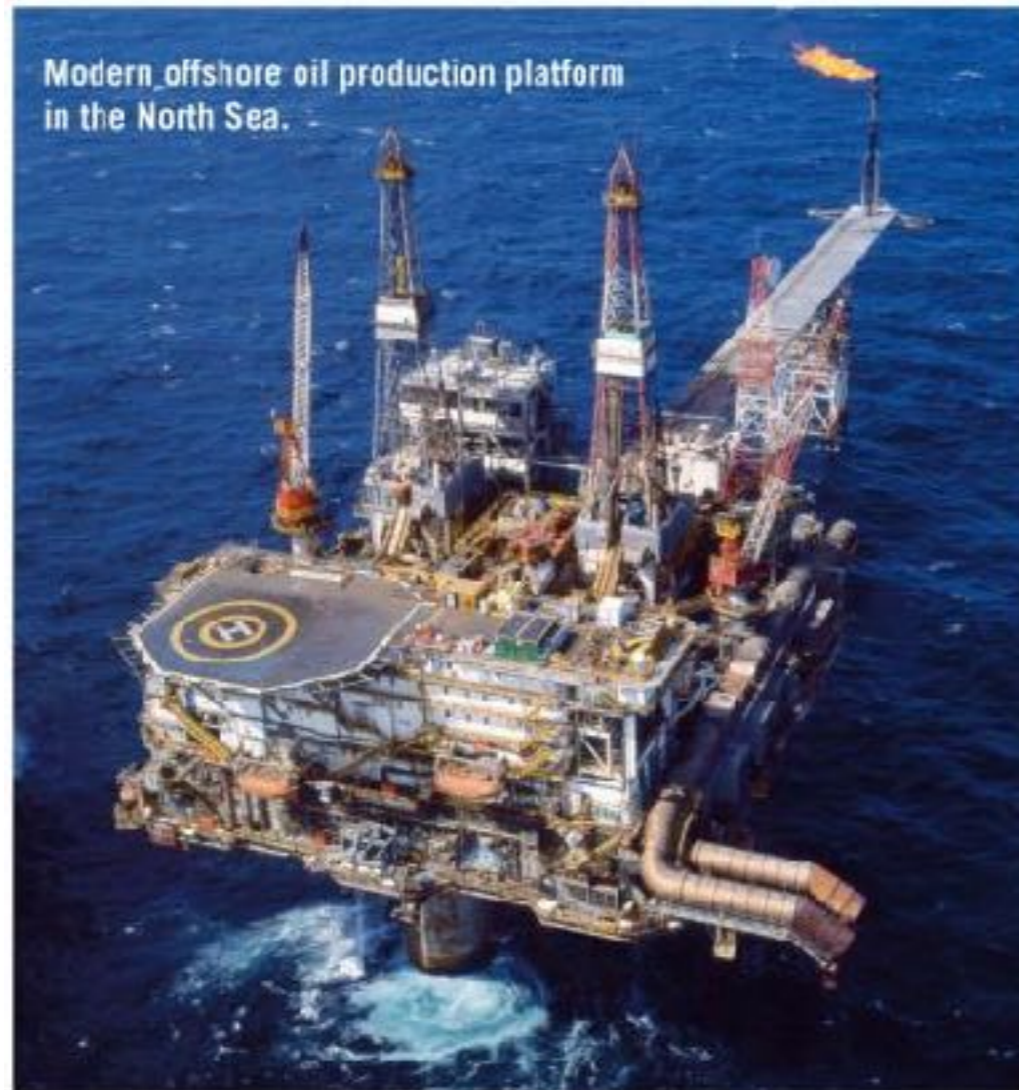


C. Salt dome



D. Stratigraphic (pinchout) trap

## *Drilling For Oil*



- 2. Oil Sands are mixtures of clay and sand combined with water and bitumen (a viscous tar)
- a. Oil in oil sands is much more viscous and cannot be pumped out
- b. Obtaining oil from tar sands requires large amounts of energy and has significant environmental drawbacks

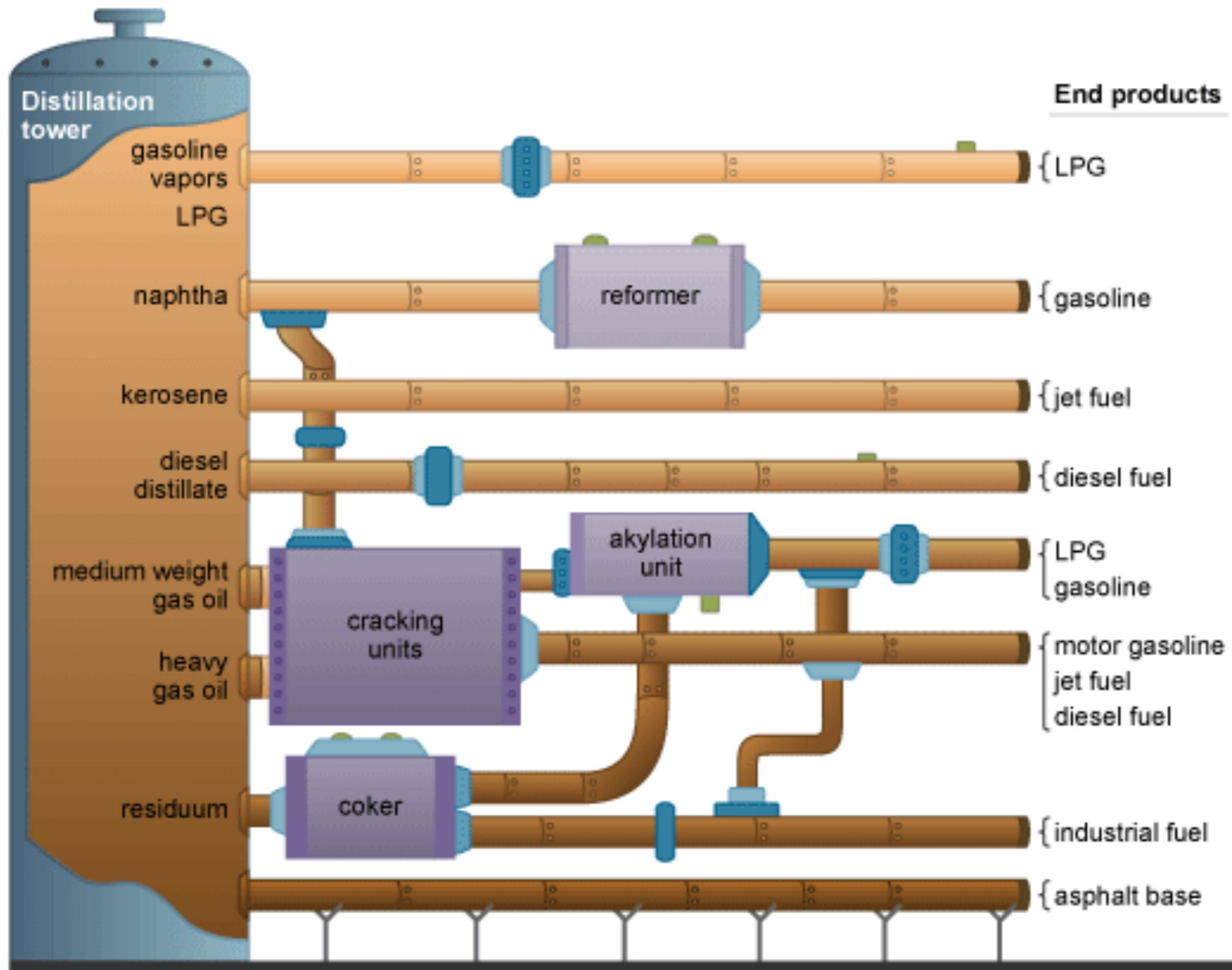
# *Oil Sands*



## *Canada Has Large Oil Sand Deposits*



*This simplified drawing shows many of a refinery's most important processes.*

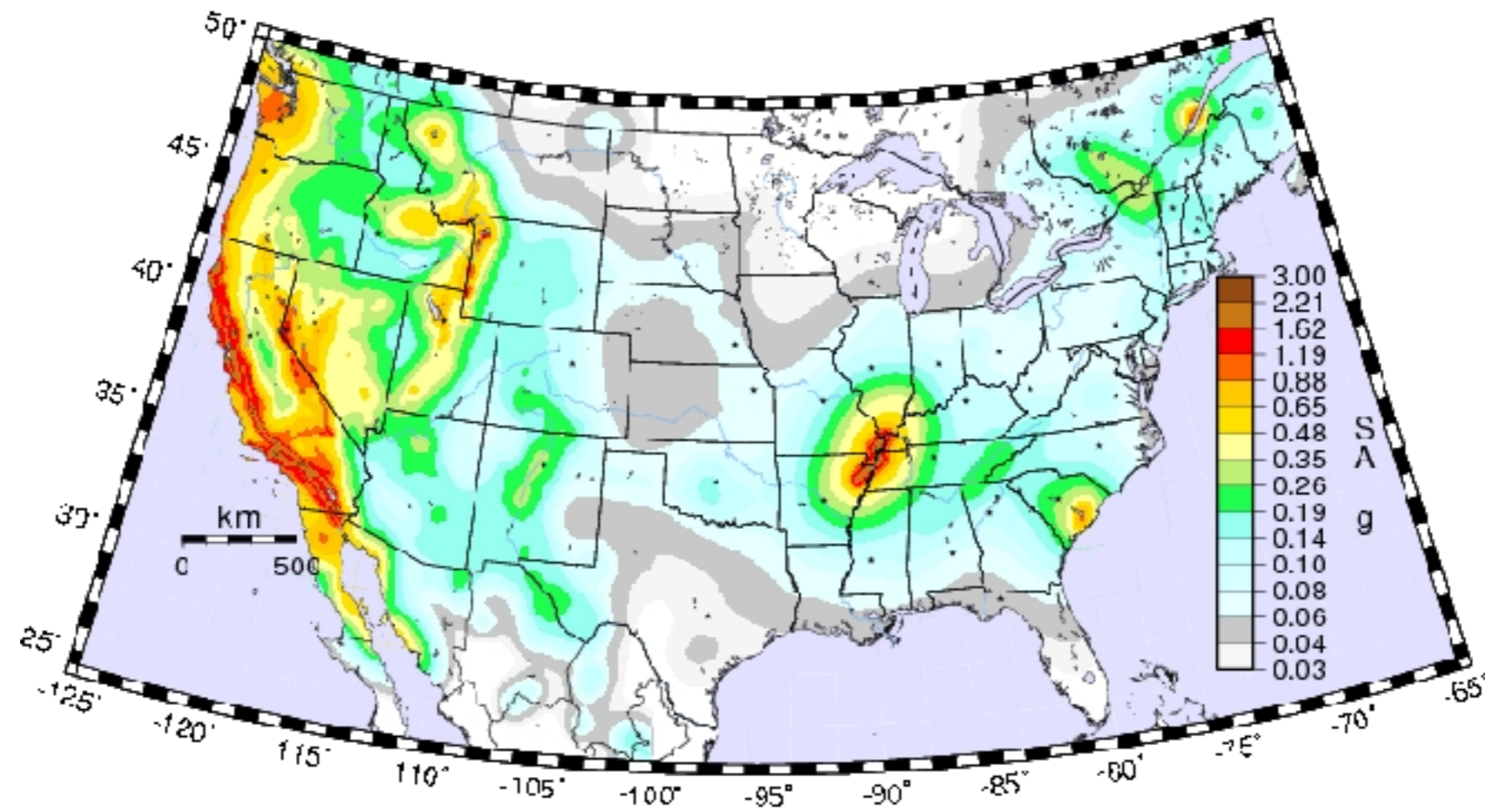


➤ 3. Hydraulic Fracturing

- a. In some regions, significant amounts of natural gas are trapped in shale with low permeability.
- b. Shale is shattered (“fracking”) to release the gas.
- c. Concerns for groundwater contamination and induced seismicity. Still a controversial practice

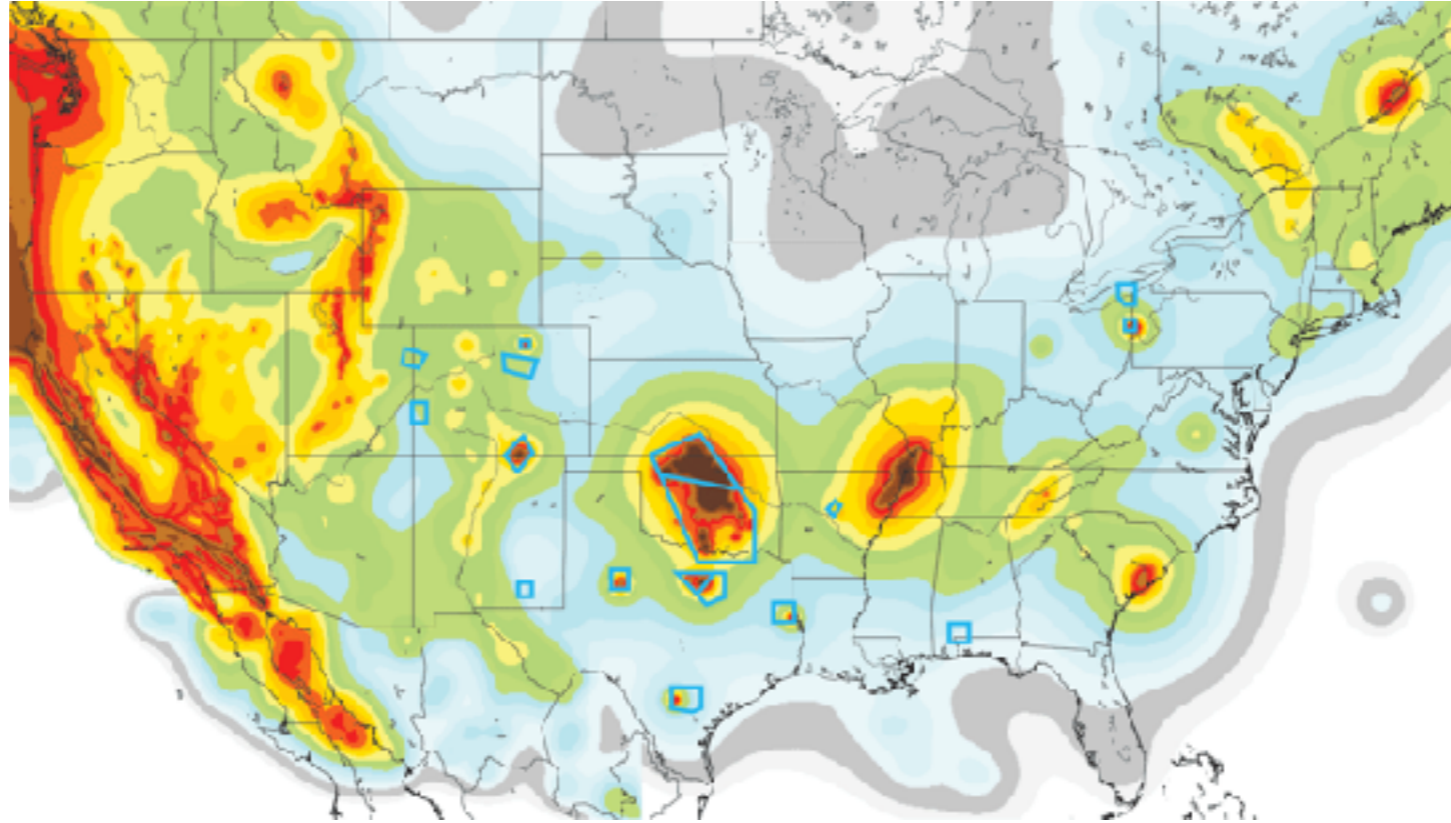


*Earthquake Risk Map*  
*Tectonically Generated*



# *Earthquake Risk Map*

*Tectonically Generated & Man-Made*

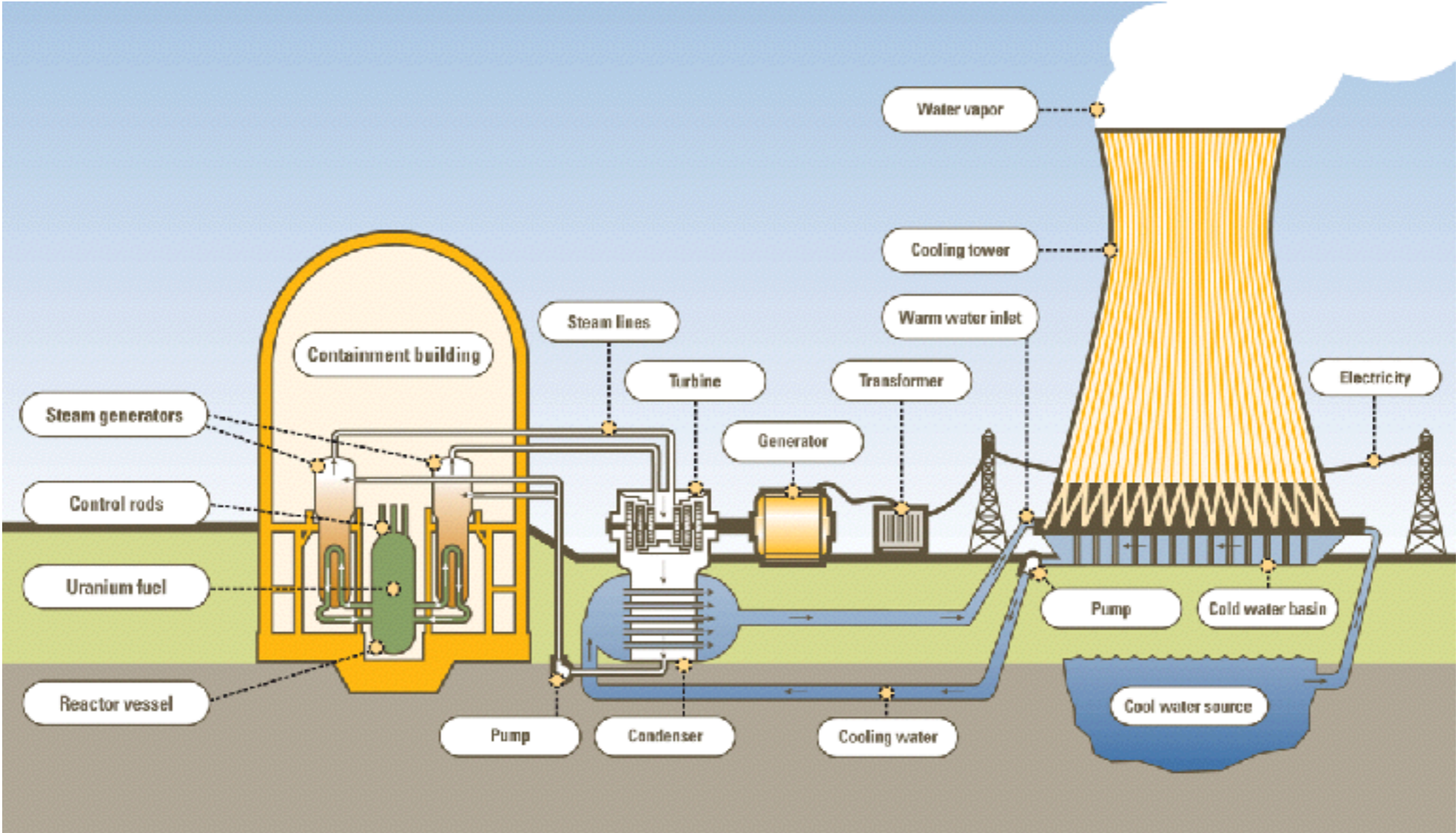


- 4. Nuclear energy is an important part of U.S. energy needs
  - a. Fuel comes from energy released by nuclear fission (splitting atoms)
  - b. Resulting controlled chain reaction releases heat used to drive steam turbines
  - c. Uranium -235 is the only naturally occurring isotope that is readily fissionable
    - (1) Primarily fuel used in nuclear power plants
    - (2) Rare element in Earth's crust & is mined

*Pitchblende - Uranium*



# Nuclear Power Plant



- 4. Obstacles to Development
  - a. Plant safety
  - b. Skyrocketing costs for safety features
  - c. Plants cannot explode like bombs, however the escape of radioactive debris during a meltdown is a major hazard.

*Chernobyl - 1986*

**Before**

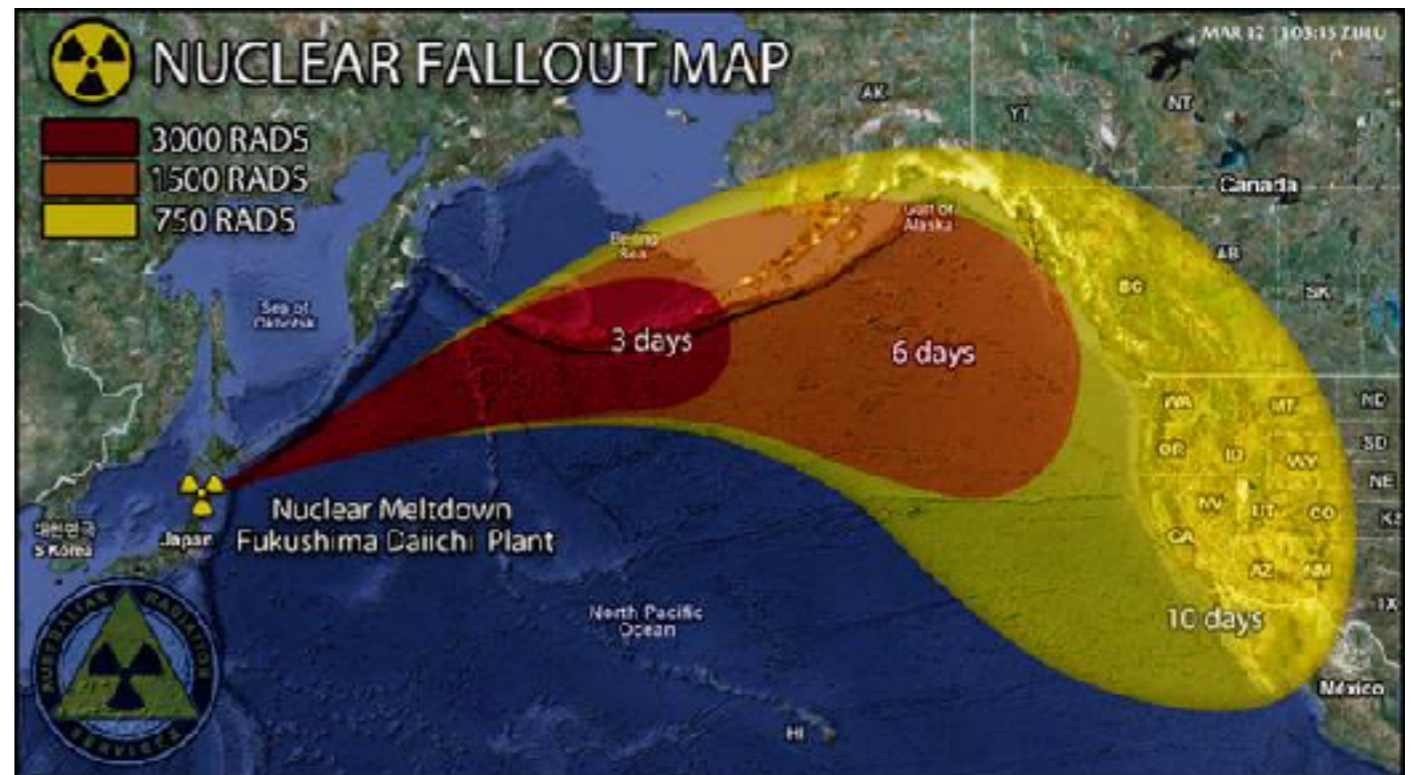


**After**





*Fukushima Daiichi - 2011*





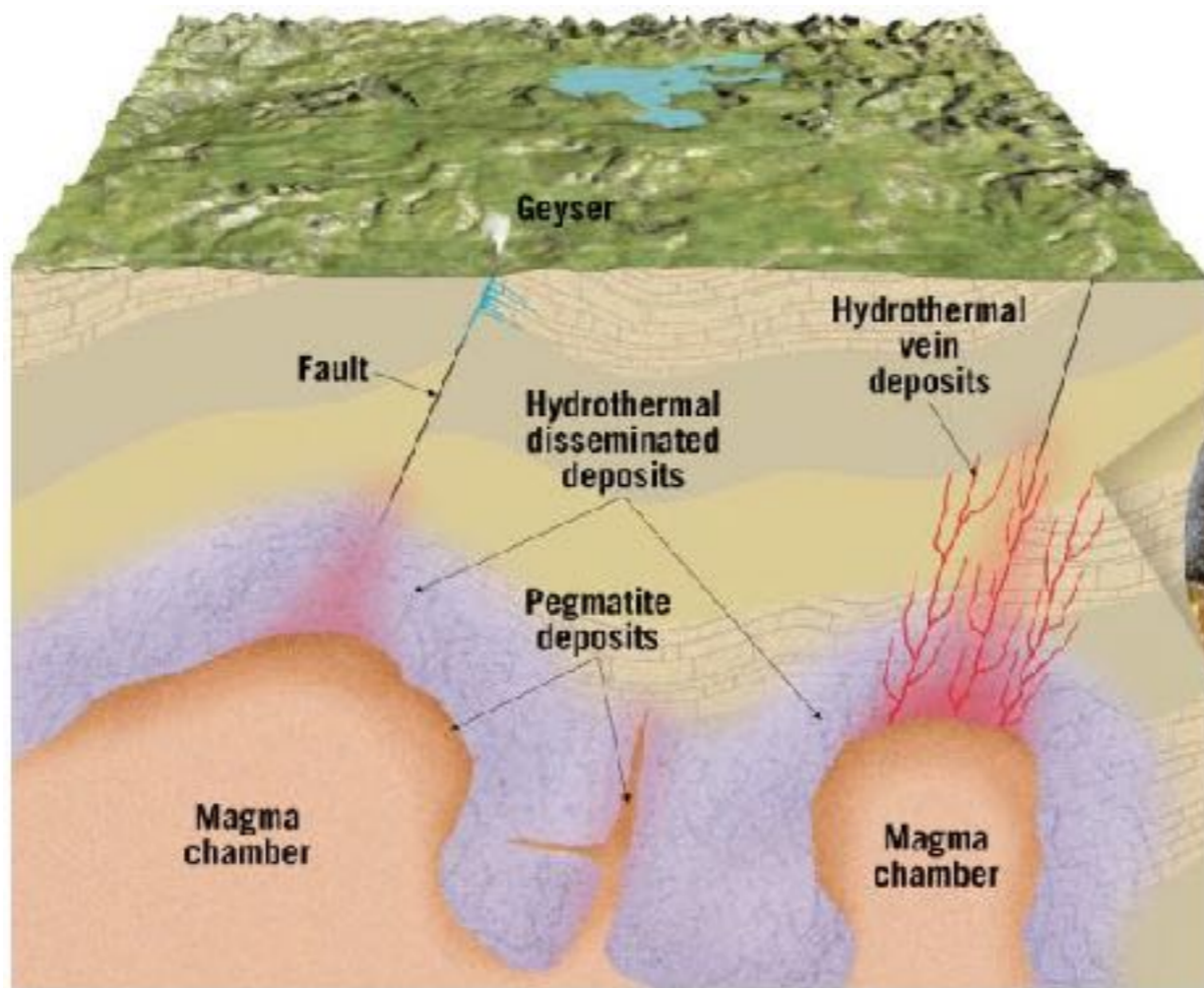
## **II. ELEMENTAL ORES**

- **A. Mineral resources are the endowment of useful minerals ultimately available commercially. Mineral resources include:**
  - **1. Reserves—already identified deposits from which minerals can be extracted profitably.**
  - **2. An ore is a useful metallic mineral that can be mined for profit.**

- B. Where Are They Found? Near ancient and new volcanic zones
  - 1. Magmatic Differentiation - Separation of heavy minerals that crystallize early or enrichment of rare elements in the residual melt.



- 2. Hydrothermal Solutions are the best known and most important ore deposits.
- a. Vein deposits - Hot, metal-rich fluids migrate through cracks in the rock before eventually depositing the metals.
- b. Many of the most productive deposits of gold, silver, and mercury occur as hydrothermal vein deposits.



**High-grade gold ore deposit in a quartz vein**

*Vein of Gold & Quartz*



- 3. Instead of being concentrated in narrow veins, disseminated deposits are distributed as small masses throughout the entire rock

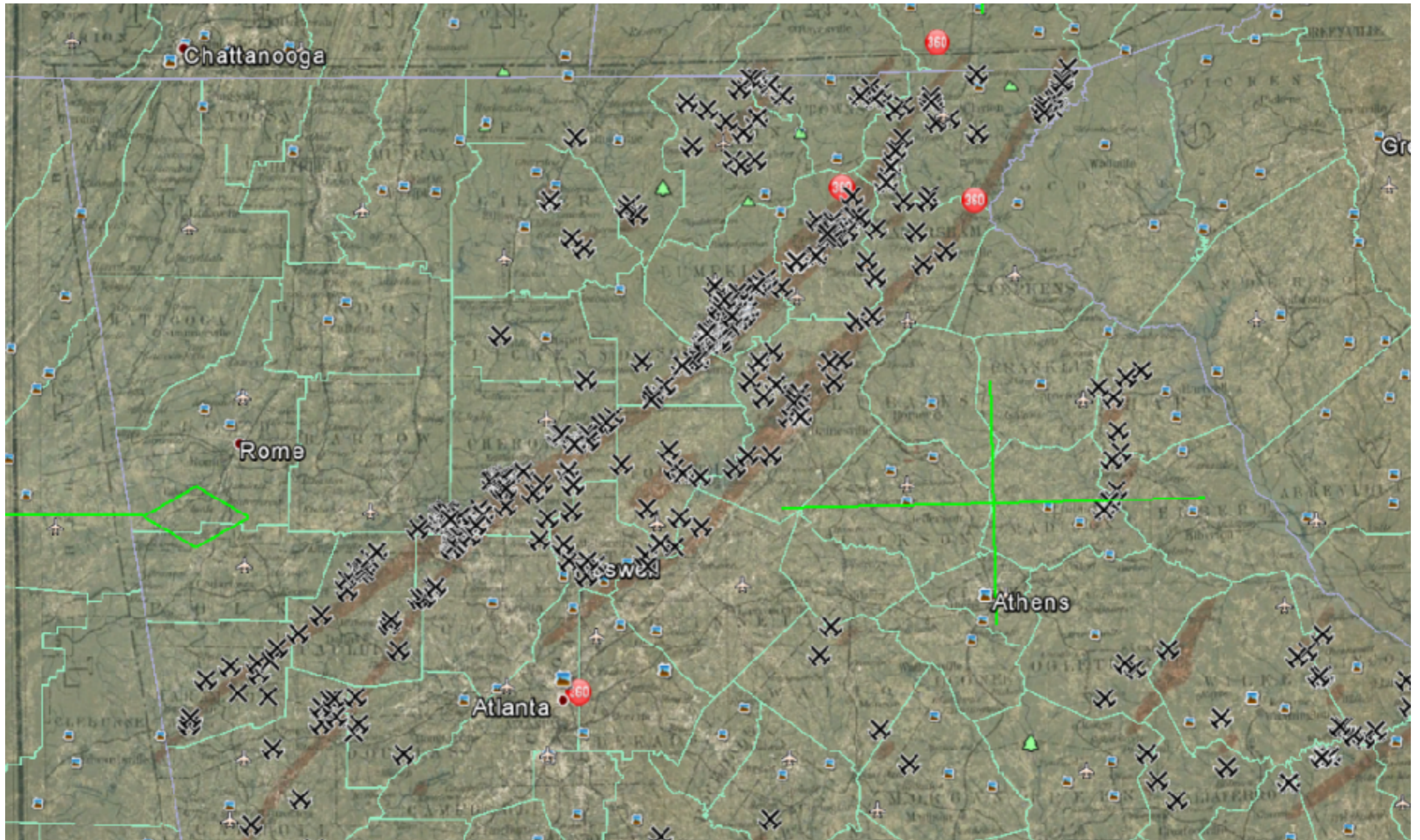


*Native Copper from Bingham  
Canyon Mine*



*Gold Nuggets From  
Dahlonega, GA*

# Gold Deposit Map - Georgia



*Gold Mine Park - Sugar Hill, GA*





➤ B. Other major metallic ores include

- 1. Bauxite - aluminium
- 2. Monazite - neodymium
- 3. Magnetite - iron
- 4. Cinnabar - mercury



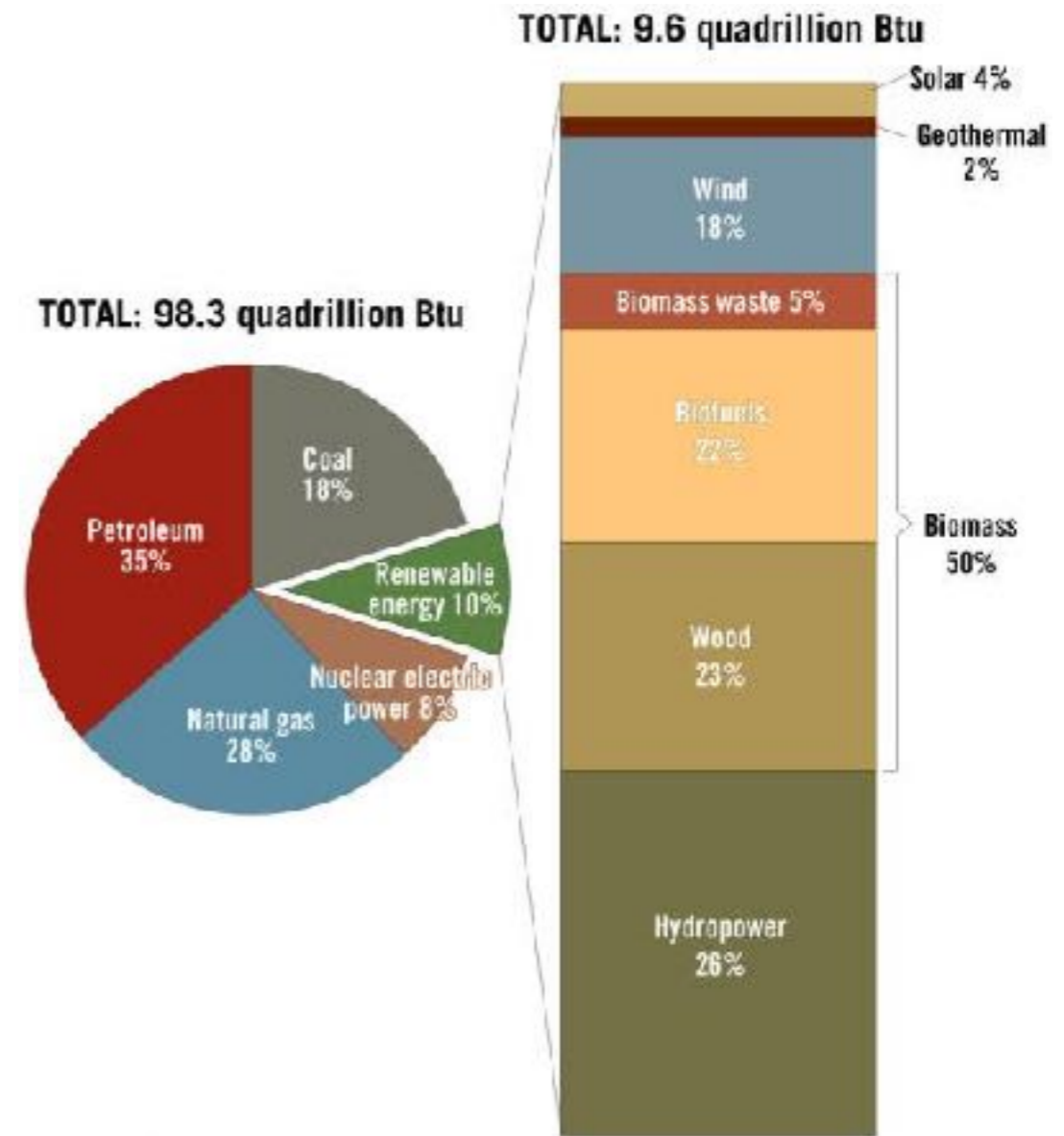
➤ **C. Non-metallic mining includes:**

- **1. Diamonds**
- **2. Marble**
- **3. Salt**
- **4. Gemstones**
- **5. Gypsum (construction)**
- **6. Potash (fertilizers)**



# III. RENEWABLE RESOURCES

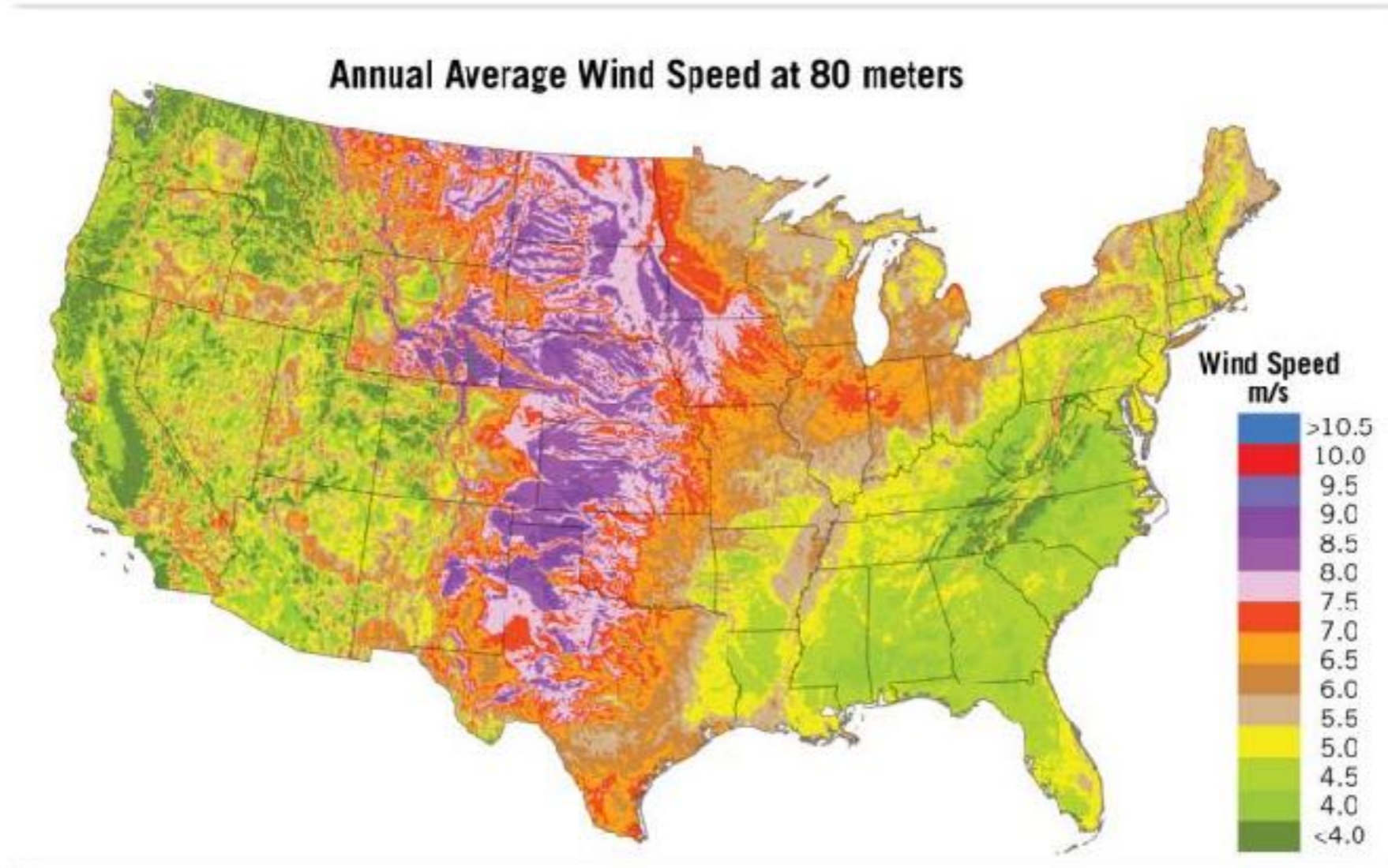
- A. Renewable energy sources regenerate and can be sustained indefinitely



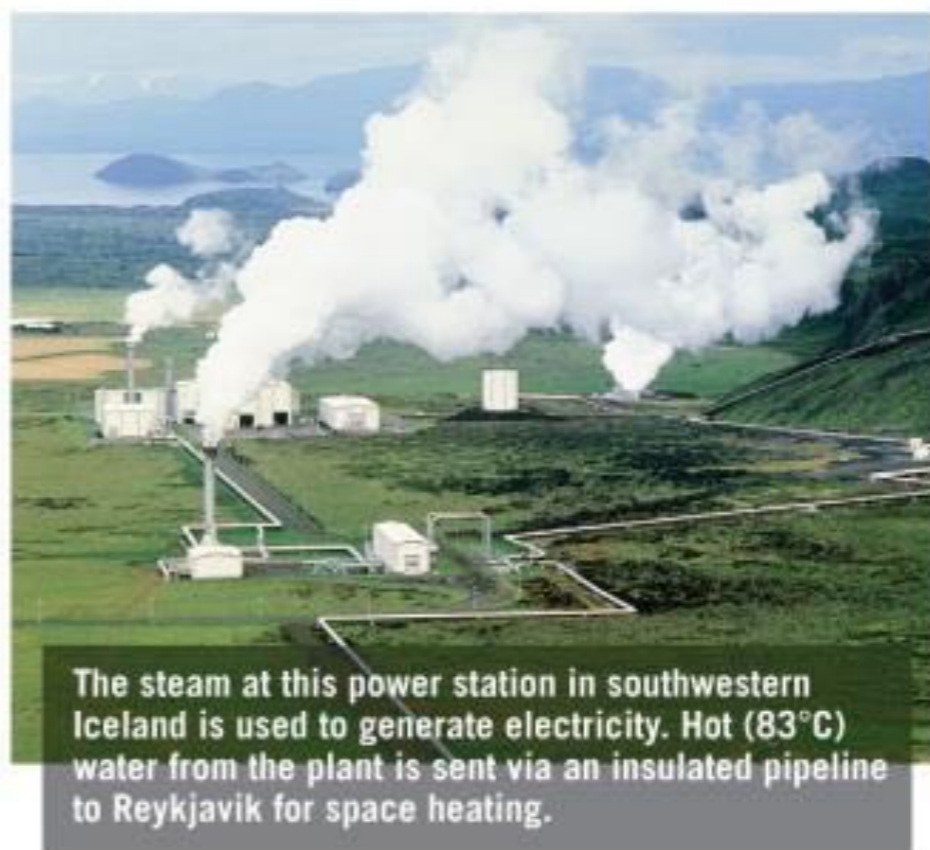
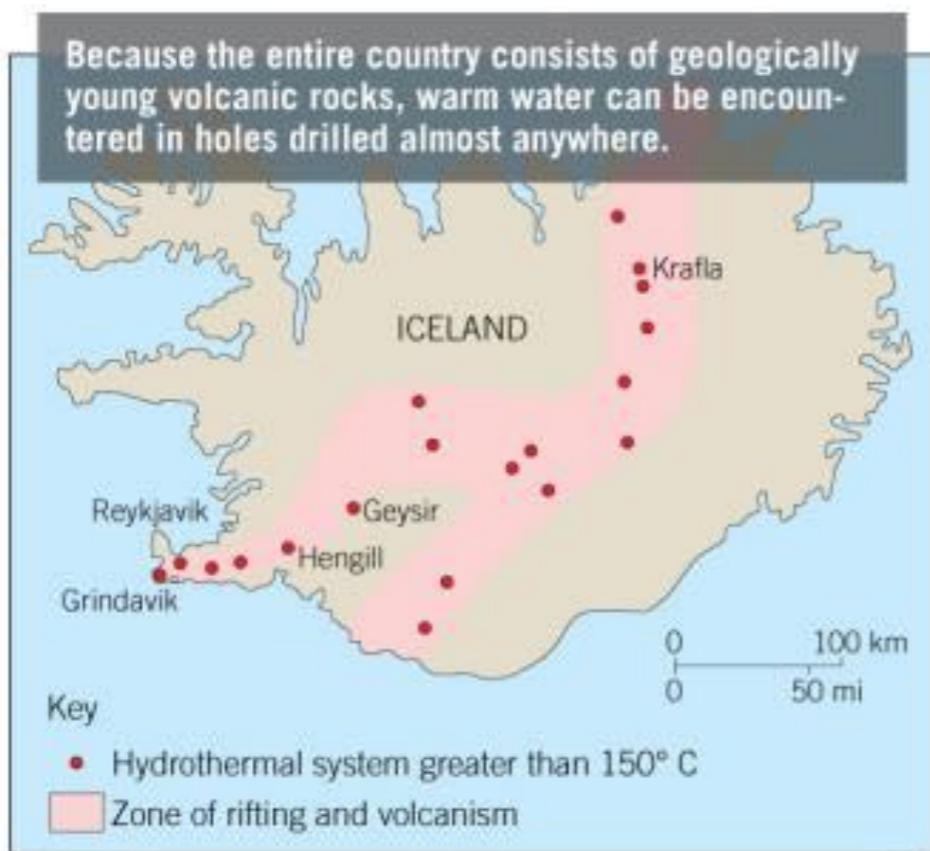
- B. Solar Energy Direct use of the Sun's rays to supply energy.



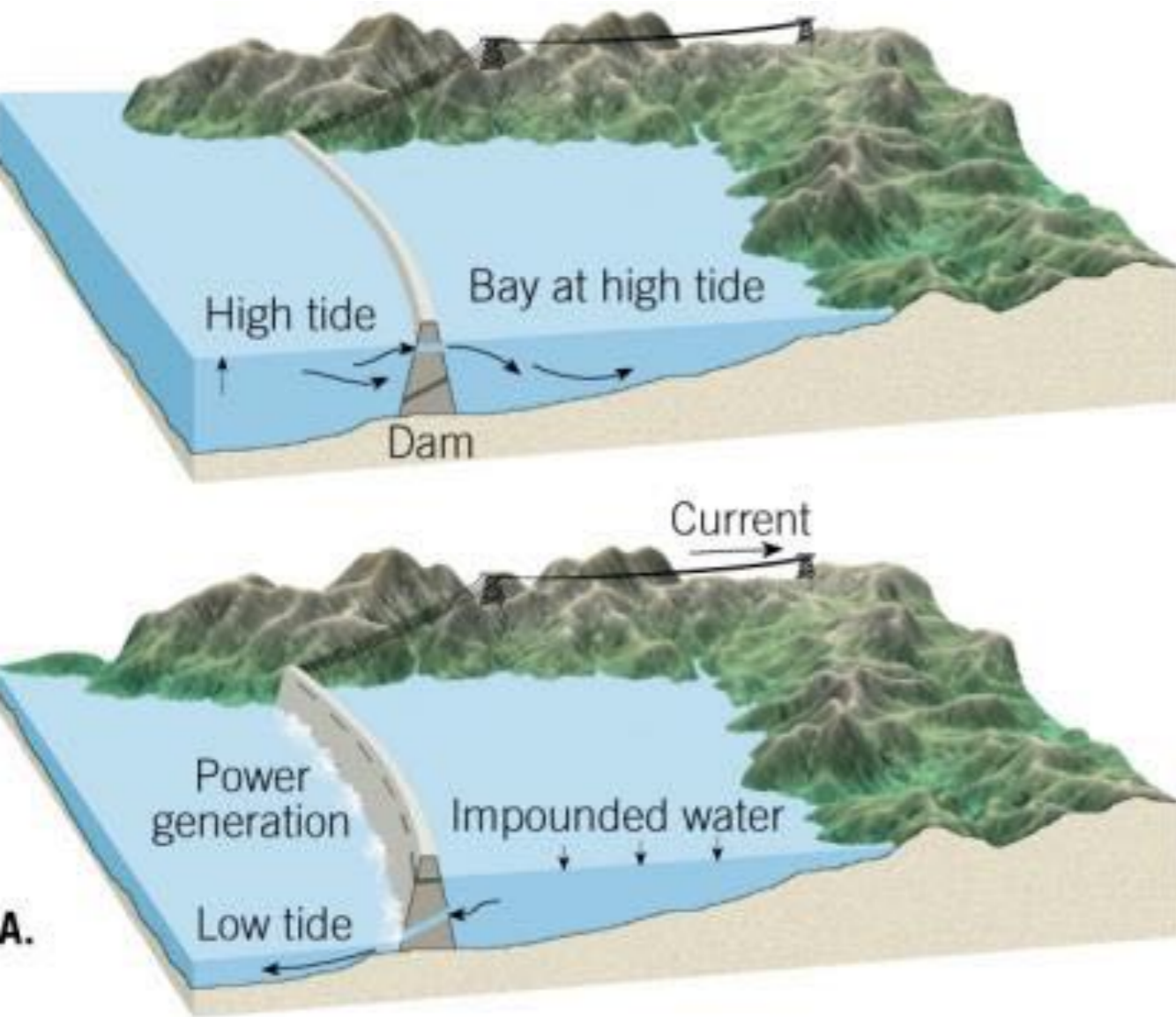
- C. Wind Energy converts the kinetic energy of a moving air mass (wind) into other forms of energy to perform work.
  - 1. Need steady winds
  - 2. Causes noise pollution & kills many birds



➤ D. Geothermal Energy is power generated by tapping into underground steam and hot water and is used for heating and to generate electricity.



- **E. Biomass—Renewable Energy from Plants and Animals**
  - **1. Biomass is organic material made from plants and animals.**
- **F. Tidal Power is harnessed by constructing a dam across the mouth of a bay or estuary in a coastal area.**
  - **1. Ocean's energy potential remains largely untapped.**
  - **2. Not every place has a large difference in their high and low tides.**



A.



B.



- **G. Hydroelectric Power is power generated by falling water used to drive turbines to produce electricity.**
- **1. Most energy is produced at large dams.**
- **2. Dams have finite lifetimes.**
- **3. Limited sites to construct dams.**
- **4. Causes major ecological changes both downriver and where the reservoir will form.**



**Cross-section of typical hydroelectric power plant**

