

## GLG 101 – CHAPTER 23 - ENERGY AND MINERAL RESOURCES

- Resources are either **renewable** or **nonrenewable**. Renewable resources can be replenished over fairly short time spans (human lifetimes). Trees and natural fibers are examples. Nonrenewable resources take MUCH longer to replenish than they take to be consumed and, so, are essentially limited in supply and can get used up. Examples include petroleum and precious metals, although metals are **recyclable**, to some extent.
- **Fossil fuels** are organic energy resources found in sedimentary rocks. These include **coal**, **petroleum**, and **natural gas**. Coal is produced from large quantities of plant matter that accumulated in an oxygen-deficient environment, such as in a swamp or bog. These undecayed organic materials are then compressed under overlying layers of sediment and rock to form a dull to shiny black rock. The longer and harder the compression, the more solid the coal will become, and the higher its energy production per kilogram (higher “grade”). The types of coal, from lowest to highest grade, are **lignite**, **sub-bituminous**, **bituminous**, and **anthracite**. All of these are sedimentary rocks, except for anthracite, which is metamorphic.
- **Coal** is primarily used for production of electricity – burning of coal (particularly if it is high in sulfur) can produce significant atmospheric pollution.
- **Oil and natural gas** are hydrocarbon compounds that form when organic-rich sedimentary layers are buried and heated at depth. The petroleum that “cooks up” from these rocks then begins to rise, due to its lower density, and can accumulate in porous and permeable sedimentary **reservoir** rocks, like sandstone. If the rocks in which the petroleum accumulates are covered by impermeable **cap rock**, we have an **oil trap**, which can be tapped by commercial wells to economically recover oil and natural gas resources.
- Combustion of fossil fuels leads to the production of carbon dioxide, sulfur dioxide, secondary nitrogen oxides (smog), carbon monoxide, etc. These pollutants have a negative effect on our environment and some (especially carbon dioxide, CO<sub>2</sub>) are “greenhouse gases” that may be contributing to global warming.
- Alternative energy resources to fossil fuels are used only for a small percentage of the power needs in the U.S. today. These include **nuclear power**, **hydrothermal** and **hydroelectric** power, **wind** power, **solar** power and **wave** power.
- Mineral **resources** are **recoverable** geologic materials found in the rocks and soil of the Earth. If such resources can currently be recovered in an economically feasible manner (i.e., at a profit), they are termed mineral **reserves**. Useful metallic minerals that can be mined at a profit are termed **ores**.
- Most of the precious metal concentrations are found in **hydrothermal veins**, where hot water solutions rising from magma bodies cool and precipitate metals and other minerals (such as quartz) in the fractures. Other disseminated ore deposits are more widespread as such fluids soak through all the open spaces in larger rock bodies.
- Other, non-metallic resources include gemstones and chemical and building materials such as rock salt, rock gypsum, gravel, limestone, marble, sand, volcanic cinders, pumice and granite.
- Sand and gravel are mined in pits along the Salt River bed and its tributaries right here in Phoenix, Arizona.
- Morton Salt company also “mines” rock salt by dissolving salt layers from sediments below ground out by Luke Air Force Base using hot water wells and pumping the salt water “brine” to the surface where it evaporates in ponds and the salt is recovered for collection, processing and sale.