**Student Handout**

**How Fossils Are Formed**

**PALEOZOIC “THEN”**

The Paleozoic Era began about 570 million years ago when a large sea covered most of the earth. This Era lasted over 300 million years and is the first era well represented by fossils. Marine life flourished during this time period and the oceans held a wide diversity of marine life. Massive numbers of marine invertebrates included trilobites, corals, brachiopods, crinoids, billions of microscopic zooplankton and phytoplankton, and many other animals, including the horseshoe crab, inhabited the early oceans.

Plankton drifted on ocean waves at or near the surface of the water and were so numerous that the colonies could actually be seen with the naked eye. These organisms were so abundant due to their ability to reproduce rapidly, but have a very short life cycle. Phytoplankton is plant-like in that it obtains its energy through photosynthesis, thus releasing oxygen into Earth’s atmosphere.

Great coral forests occupied much of the ocean floor with marine algae increasing nearer the end of the era.

All living organisms contain carbon, so when they died, their remains sank to the deep ocean floor and were covered with mud, sand and sediment from eroding mountains and surrounding areas. They were buried quickly on the ocean floor, and because their remains lacked oxygen, the rate of decay or decomposition was limited leading to the ancestral building of the Appalachian Mountains.

While there were few land organisms at the beginning of the Paleozoic Era, by the middle of the Era groups of land plants began to appear, and by the end of the Era, reptiles and amphibians began to live on the land. Insects became abundant.

While jungles were present in the Paleozoic Era, there were no birds, monkeys, or many other animals since they did not appear until later. Large plants lived in or near swamps.

The Paleozoic Era ended with the largest mass extinction in Earth’s history—at least 90% of all marine species became extinct. Many scientists believe this occurred because of changes in the ocean environment.

**MESOZOIC “THEN”**

 The Mesozoic Era began about 250 million years ago and is known as the “Age of Reptiles” because reptiles, such as dinosaurs, ruled over the land and waters. Horseshoe crabs, plankton and coral forests remained in the ocean waters and insects were numerous.

More than half of the ocean had disappeared because of evaporation, volcanoes, earthquakes, and sediments that were layered on the sea floor. According to the Theory of Plate Tectonics, the supercontinent Pangaea was slowly being torn apart with the plates drifting in opposite directions creating separate oceans. In North America the Arctic Seas covered much of the land.

 Small mammals began to appear about the same time as the dinosaurs, and birds had appeared by the end of the Mesozoic Era. Plants consisted of ferns and gymnosperms such as cycads, ginkgoes, with conifers being prevalent as well. By the end of the Era, angiosperms (seed-producing plants) began to appear and mountain ranges such as the Rocky Mountain Range had begun forming.

 The end of the Mesozoic Era is marked by the mass extinction of about 20% of all species on earth, including the dinosaurs. Scientists believe this was caused by global climate change possibly created by an asteroid landing near what is now the North American continent.

**CENOZOIC ERA “THEN”**

Around 250 million years later, we are currently in the Cenozoic Era. The land became dominated by angiosperms (flowering plants), mammals, birds and insects. Humans have appeared and walk on the earth where dinosaurs once roamed, leading to the rise in civilizations as we know it. Plant species increased gradually leading to adaptations for mammals and birds.

Tectonic plates have now drifted to where we know them with major oceans and mountain ranges being formed. Volcanoes became active worldwide, particularly at plate boundaries. Erosion and other sediments now fill the seas and mountain ranges have formed on both the ocean floor and the continents. Some organisms, such as coral and horseshoe crabs, continue to thrive.

Sedimentary rocks make up the bulk of rocks on Earth’s surface with mineral deposits such as petroleum, gold, silver, copper, and bauxite holding economic value. Surface deposits of sand, gravel and groundwater also hold economic value.

**PALEOZOIC “NOW”**

 Deep below the surface of the earth, heat and pressure over millions of years have literally cooked organic materials creating hydrocarbons through a series of complex chemical changes.

Organic materials include plant or animal organisms that were once living. These hydrocarbons are known as fossil fuels because they were formed from the remains of dead sea or swamp organisms exposed to high temperatures within the earth ranging from 66 to 149 degrees Celsius (150 to 300 degrees Fahrenheit) for millions of years.

Oil and natural gas make up petroleum which is a mixture of hundreds of different hydrocarbons formed from marine invertebrates included trilobites, corals, brachiopods, crinoids, billions of microscopic zooplankton and phytoplankton that were buried deep within the earth. Pressure from sedimentary layers and heat within the earth create the hydrocarbons that are stored in traps, covered with a layer of solid rock or clay to keep the oil and gas from escaping.

**MESOZOIC “NOW”**

 The Mesozoic Era ended with the mass extinction of dinosaurs and many other reptiles. Their corpses became covered with layers of sediment that were thousands of feet deep. These layers consisted of dead plankton, fossilized sea creatures and layers of sedimentary rock. Heat and pressure over millions of years have literally cooked organic materials creating hydrocarbons through a series of complex chemical changes. Inorganic materials (minerals) became layers of sedimentary rock.

Organic materials include plant or animal organisms that were once living. These hydrocarbons are known as fossil fuels because they were formed from the remains of dead sea or swamp organisms, exposed to high temperatures within the earth ranging from 66 to 149 degrees Celsius (150 to 300 degrees Fahrenheit) for millions of years.

Oil and natural gas make up petroleum which is a mixture of hundreds of different hydrocarbons formed from the remains of dinosaurs, prehistoric sea creatures, vegetation, and marine invertebrates including trilobites, corals, brachiopods, crinoids, billions of microscopic zooplankton and phytoplankton that were buried deep within the earth. Pressure from sedimentary layers and heat within the earth create the hydrocarbons that are stored in traps, covered with a layer of solid rock or clay to keep the oil and gas from escaping

**CENOZOIC “NOW”**

Around 250 million years later, we are currently in the Cenozoic Era. The land has become dominated by angiosperms (flowering plants), mammals, birds and insects. Humans have appeared and walk on the earth where dinosaurs once roamed, leading to the rise in civilizations as we know it. A tremendous increase in the human population has led to urban development and created problems such as food supply and pollution. Humans have come to rely on fossil fuels for energy.

Plant species continue to increase leading to adaptations for mammals, birds, reptiles, amphibians and fish. Tectonic plates have drifted to where we know them with major oceans and mountain ranges being formed. Volcanoes are active worldwide, particularly at plate boundaries. Erosion and other sediments now fill the seas and mountain ranges have formed on both the ocean floor and the continents. Some organisms, such as coral and horseshoe crabs, continue to thrive.

Sedimentary rocks make up the bulk of rocks on Earth’s surface with mineral deposits such as petroleum, gold, silver, copper, and bauxite holding economic value. Surface deposits of sand, gravel and groundwater also hold economic value.

Technology has made it possible for humans to access fossil fuels held deep within the earth while preserving the environment. Oil and gas wells access these fossilized fuels providing energy and jobs for our world.