**The Planet Earth**

**The Age of Earth**

The Earth has been the main support of living organisms for approximately of 4.54 billion years and serves as a home to an estimate of 7.4 billion people. Scientists of the past tried to determine the age of the Earths by analyzing the records of previous levels of the sea, the time it took for Earth and the Sun to cool down to reach the temperatures of present time, and the salinity of the ocean. However, with the progression of science it has been found that these methods of determining the Earth’s age is unreliable; in example, due to the of rise and fall of the ocean it has proven that the elevation of the ocean is a process that happens randomly rather than simply declining at a gradual rate. After this failed attempt scientists then turned to the rocks of the planet in order to date the Earth, but this method soon was discarded. In previous studies it has been shown that from the shifts of plate tectonics the initial rocks of the Earth’s crust have been recycled, melted, and reformed into the Earth a very long time ago. **Tectonic plates** are very large irregularly shaped portions of solid rock that are typically components of both continental and oceanic lithospheres. Oceanic lithosphere represents rock presented in the form of basalt whereas continental rock is made of granite

In the process of trying to scale the Earths age scientists have been using the process of radiometric dating. Radiometric dating is used by geologists in order to estimate how long ago rocks may have formed. This type of dating process also is used to conclude the ages of fossils in the rocks which already have a generated age or for the fossils that are buried deep within the Earth’s soil. **Radiometric dating** is based off the timing of how long it takes for radioactive elements to decay. **Radioactive elements** are elements that are subject to spontaneous degeneration of its own nucleus accompanied by the emission of alpha particles, beta particles, or gamma rays. Any elements with an atomic number larger than 83 is considered radioactive. Radioactive (parent) atoms are generally unstable and will eventually decay into stable (daughter) atoms. After rocks have been melted and molted, the composition of the rock cools and forms into **igneous rocks.** With the formation of the igneous rocks, radioactive atoms are then trapped inside and eventually the radioactive atoms decay at a predictable rate. Once the atoms begin decaying, a quantity of unstable atoms is left in the rock and can serve as a comparison of stable atoms that are in the rock. Scientists can then use this comparison in order to determine the amount of time that has passed since the rock formed. However, when dating fossils another process is used since fossils are typically found in **sedimentary rock.** A **fossil** is the remnants or the impression of ancient and prehistoric organisms that have preserved in a petrified form as a mold or cast within a rock. Sedimentary rocks are mostly created under water and are cool. There are three types of sedimentary rocks: clastic (quartz and clay), organic (limestone and chert), and chemical (gypsum rocks and rock salt). Sedimentary rocks are dated by using radioactive carbon which contains a radioactive isotope of carbon; because carbon decays at a quick rate, sedimentary rocks can only be used to reliably date fossils when the fossil is less than 50 thousand years old. Although, in order to figure the dates of fossils older than 50 thousand years, scientists use substances such as volcanic ash or igneous rock within a very close proximity above or below the fossil in order to begin the dating process. Within the substances elements such as uranium and potassium are used to determine the age of the fossil because these are the elements that decay slower than most of the others. With the respective process of calculating radioactive elements scientists are then able to determine the age of the fossils at hand.

**Formation of the Earth:**

One of the many astounding wonders to humans is how the earth itself was formed and why Earth is a planet with the largest amount of liquid water and carbon. Not only is water and carbon abundant on Earth but many of the life forms on Earth use both in order to make organic matter. Although there is no completely accurate way to tell how the Earth was formed, scientists often construct the history of our present solar systems by observing regions where stars and other galaxies that may be deriving. Scientists infer that stars are formed by large gaseous clouds that trap star dust from the presence of their gravity. As the cloud decreases in size it begins to settle and form into a disk-shaped structure. As more star dust material is pulled toward the center of the disk density gradually increases until central pressure causes nuclear fusion reactions and then the star is born. Scientists believe that the Earth was created in the same process but with a larger quantity and diversity of material. It is believed that the Earths formation was caused by the condensation and coalescence of rocky and icy material. After a solid body of mass is formed from the linking of the ice and rock the rocky body then attracts and accumulates gas from the circumstellar disk. **Circumstellar disks** are ring-shaped bodies that derived from the accumulation of star dust, gas, and the collisions of asteroids. Previous observations of planets that are in close proximity to surrounding stars with masses similar to that of the sun show that the planet formation is typically the outcome of star dispersal and star formation.

There are also many theories that meteorites helped the Earth form in various ways. **Meteorites** are usually categorized as iron or stony objects that are made up of oxygen, iron, silicon, magnesium and other elements that fly into the Earth’s atmosphere. If the meteorite can make it past the atmosphere, it then possesses the ability to create a lot of damage and could possibly pose as a detrimental threat to the human population. Scientists use the history of these objects in order to formulate precise radiometric dating that suggests that high temperatures within the early millenniums of the Earth were associated with the impact of meteorites being assimilated into the Earth. With the use of radiometric dating we can accurately test the decay of meteoroid material back to 4.567 million years ago and further conclude that these meteoroids were some of the first solid material to make up the Earth’s surface. Coincidently, many samples of meteoroids contain similar elements on Earth such as hydrogen, helium, lithium, carbon, nitrogen, oxygen, and some of the noble gases. It has also been found that meteorites contain the same components that can be found within Stardust.

According to the Big Bang Theory the formation of planet Earth began about 13.7 billion years ago from a cataclysmic explosion that created all matter and space instantaneously. As a beginning result, atoms were formed and as the debris began to cool atoms hydrogen and helium where then formed. In a few hundred million years, clouds of these gases where then condensed into little stars that eventually made up the composition of galactic systems. Astronomers have suggested that in stars, more massive than the sun, other thermonuclear reactions occurred that generated all the elements of the periodic table ending at the number 26 (iron). Elements ending the number 26 are thought to have been created at the extreme temperatures emitted by the explosion of star death; the stars that are known to have caused such explosions are estimated to be at least 10-20 times larger than that of the sun.

**How Did Earth Develop Its Oceans and Atmosphere**

The atmosphere of ancient Earth is assumed by scientists to have been about 100 times thicker than the atmosphere of present day Earth. Once all the water in the atmosphere was released, it precipitated onto the Earth causing the formation of oceans and in return the atmosphere was mostly made up of carbon dioxide. Eventually, the excess carbon dioxide would partially dissolve and the remnants would then fall into the water, causing the water to become acidic. As a result the ocean was then chemically acidic it attacks the ocean floor which results in dissolved solids leaving the ocean rich in minerals. It is believed by scientists that the removal of carbon dioxide did not halt until it reached the pressure of carbon dioxide similar in that of todays value (.0003 atmospheres). With the drop of carbon dioxide in the atmosphere the temperature is predicted to have dropped well below freezing and therefore aided in the freezing of the surface of the Earth. With the population of organisms increasing gradually over a long period of time, so did the accumulation of methane and carbon dioxide; when these two gases built up in the atmosphere they acted as greenhouse gases. **Greenhouse gases** are gases that trap heat in the atmosphere such as methane, carbon, and nitrous oxide. With the buildup of gases in the atmosphere came the result of increasing temperatures; with increasing temperatures the icy core of the Earth melted leaving some areas completely covered in water while other areas where left as terrestrial land.

**The Supporting Energies of Earth**

It is well known that the majority of life on Earth requires light and/or heat in order to maintain and support biological processes. There are two main sources that supply energy to the Earth. The first is the Sun; the Sun is the most powerful and is also the largest supplier of energy to Earth and its organisms. The sun emits on average about 342 watts per square meter over the Earth`s surface. A **watt** is a unit of power, which is, energy per time. So, in comparison to a light bulb the sun emits approximately six times the wattage that a light bulb produces. The other supply of energy comes from the Earth itself. This type of energy is known as **geothermal energy** and is derived from the heat that is distributed from the internal core of the earth**.** Another source of geothermal energy comes from radioactive decay. **Radioactive decay** occurs from the process in which an atom simultaneously emits particles from its nucleus; as a result heat is emitted. There are three main radioactive isotopes: thorium, uranium, and potassium; these isotopes emit the largest heat contributions to Earth. The heat emitted from these isotopes escape the surface of Earth at about 0.06 watts per square meter.

Outside of the Earth’s two main suppliers of energy there is one more, the Moon. However, the moon does not emit energy in the form of heat; instead it creates waves of energy from its gravitational force; once the gravitational force of the moon meets with the frictional force of the Earths it results in the Moon pulling the Earth. This phenomenon is what causes tides from bodies of water and also plays a part in wind speed.

**How Did Life Begin?**

The biggest question that many scientists ask about life on Earth is exactly what did life derive from. Considering that all current life on Earth are dependent on chemical processes it is not hard to assume that chemicals were indeed the initial materials that life derived from. However, scientists use two different approaches in order to gain factual evidence of how biological processes could have begun. The first approach we will discuss is known as the **top-down approach**; using this approach allows scientists to observe living cells and their complex molecular systems and biological processes. The second approach is known as the **bottom-up** approach. This approach uses the knowledge of Earth scientists in order to specify certain physical settings, energy resources, starting materials of Earth, chemical compounds, and the relationships between these components.

In order to understand how life could have derived from prebiotic chemicals (chemicals that existed before the emergence of life) we must first be aware of the catalysts that are available in the environment. A **catalyst** is a substance that increases how fast a chemical reaction occurs. As found in every living cell, the chemicals reactions that life forms are dependent on all require catalyst, typically enzymatic proteins. In comparison, it is believed that prebiotic reactions required protein type catalysts as well in order to undergo certain energy producing reactions. These catalysts also aid in the synthesis of long chain molecules that are now known as amino acids and proteins which are responsible for the make up for all living organisms. Some of the most important catalysts that are used in experimental advances pertaining to prebiotic chemistry are found by the use of metal ions such as the coordination of chemical reactions essential to the development of metabolism and mineral surfaces. As mentioned earlier in the section about how oceans and the Earth`s atmosphere was developed, water fell from the atmosphere as well as other elements caused from the collision from other planets. It is believed that those metallic ions that fell into different bodies of water that eventually could possibly the cause of what started prebiotic catalytic reactions. Due to the fact that most biological catalysts typically depend on a substance that contains a metal ion scientists can confidently assume that metals such as: iron, magnesium, zinc, copper, nickel, cobalt, iron-sulfur, and manganese are all responsible for the initiation of biological processes. For example, a magnesium ion dwells in the molecules of chlorophyll that aid in the trapping of energy derived from sunlight and ultimately support the process of photosynthesis. In another example in regards to humans, an atom of iron is what is essential to the transportation of oxygen from hemoglobin resulting in mammalian respiration.

Another factor that may have played a great role in the initiation of prebiotic processes is the presence of mineral surfaces. For examples, clay minerals have been identified to catalyze the generation of lipid micelles. Lipid micelles are molecules that have the ability to arrange themselves into spherical structures. The shape of micelle molecules is due to the amphipathic being of fatty acids. If a molecule is amphipathic, the molecule contains a region that is attracted to water known as a **hydrophilic** **region** and another region that is repelled by water known as a **hydrophobic region.** Not only do clay minerals catalyze the assembly of lipids, they also aid in catalytic process that causes nucleotides to link and ultimately form nucleic-acid-like polymers and also pentose sugars, the most biologically important sugar here is ribose considering this is found in the makeup of both DNA and RNA.

**Conclusion**

Although there is substantial scientific evidence that makes these findings sound true, there is no hard evidence that everything that was mentioned before is 100% correct. However, whether you believe in the scientific version of how the Earth was created or the religious version we must start taking better care of our planet. Humans have caused the greatest impact on Earth and we have caused the largest amount of damage to the planet than any other **biotic** (living) or **abiotic** (non-living) factors. From issues such as global warming, water pollution, over use of natural resources, and causing extinctions due to habitat fragmentation and habitat loss we as humans are destroying the Earth at a much faster rate than it was formed.

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