INTRODUCTION TO EARTH SCIENCE

Geology: The Study of the Earth

"Geology" is a general term used to refer to the study of the Earth. The field of Geology includes a number of specialized disciplines including:

- Mineralogy - the study of minerals
- Paleontology - the study of fossils
- Petrology - the study of rocks
- Geophysics - the study of the physics of the Earth and its atmosphere, which includes the last three listed here
- Meteorology - the study of weather and weather prediction
- Seismology - the study of earthquakes, and
- Volcanology - the study of volcanoes, to name a few.

The fields knowledge and techni to understand system, and the ur

Many Re

Geology is ements the others. Each specialty, though, is so complex that it demands special focus by scientists. Consequently, mineralogists specialize in minerals, their forms, properties, formations, relationships, and uses. Seismologists specialize in the geophysics related to earthquakes, why they happen and when, how rock responds to earthquakes, and the damage they can create. Seismologists work closely with engineers to design buildings and structures that are less vulnerable to earthquake damage. Meteorologists focus their study on the weather and the various components that affect weather systems. These are but a few examples. When a reference is made to "Geology" or "Earth Sciences" (as it is sometimes called), it is important to understand how complex this group of sciences is.

Lesson Checkpoint:
Why are there so many Earth Science specialties in the field of Geology?

As scientific inquiry develops and becomes increasingly complex, geologists need to have a broad scientific background. Today geologists are benefitted by having training in biology, chemistry, physics, computer sciences, and other scientific fields. There is even now a highly specialized field called *Geological Forensics* in which geological information is gathered and interpreted to determine what factors influenced past geological events and how these events impacted people, their homes, and their businesses. For instance, a significant landslide in California late in 2007 destroyed a number of expensive homes built on a terraced hillside. Geological forensic scientists determined that the landslide was the result of leaking water and sewer pipes, which weakened the dirt supporting the homes and roads.

Scientific Inquiry

As in all other sciences, geologists follow the scientific method. Initial questions are asked and hypotheses are drawn. The hypotheses are tested in a manner that can be repeated by other scientists to verify and/or challenge the conclusions ultimately made. Eventually the information is compiled and studied, final conclusions are made, and the material is published. This gives the wider scientific community a chance to review the work, study the results, and even repeat the experiments to determine whether the initial conclusions are indeed valid and accurate.

Lesson Checkpoint:
Why Do Geologists Follow the Scientific Method?

A Dynamic and Growing Science

Since the 1960's, the study of Earth Science has developed and advanced dramatically. The **theory of plate tectonics** in particular has revolutionized the understanding of many parts of the science of geology. The concept that pieces of the Earth's crust are moving relative to one another has provided explanations for the presence of deep sea mountains and trenches, earthquakes, volcanoes, continental mountains, and more. Earthquakes are explained by the motion of pieces of the crust against each other due to the pressures of the moving plates.

The "Ring of Fire" around the Pacific Ocean basin is a collection of volcanoes and associated earthquakes caused by plate tectonics. Before the plate tectonic theory was developed, geologists believed that mountains formed as the molten Earth cooled. As it cooled, the crust buckled and folded. We now know that mountains like the Himalayas were formed by the forces of two continental plates colliding with each other.

In addition mistry, and physic fe science, geochemis Advancem uildings, roads, and an earthquak ortantly, lives.

Geologists have even discovered that technologies developed for one science have important applications in Earth Science. For example, paleontologists are using CAT Scan machines, which are used to see inside humans, to see "inside" fossils. This has led to discoveries about the structures and function of fossilized remains that in turn help paleontologists understand ancient ecosystems. Lessons learned from ancient ecosystems can help us better understand modern ecosystems as well. The development of deep sea submersibles has allowed geologists to literally visit the deepest portions of the ocean floor which has increased our understanding of sea-floor spreading and plate tectonics.

Lesson Checkpoint: What recently developed geological theory has changed how we understand earthquakes?

The Various Branches of Earth Science

In the early years of Earth Science, geologists focused their studies exclusively on the Earth, in particular its rocks and minerals. Today, "geology" mmonly referred to include the study d our universe a Increased uter capabilities also a more preci ome planet. Me involved in creating weather and are quite capable of accurately predicting temperature, precipitation, wind speeds and directions, and other aspects of our daily weather.

Since the 1970's, the United States and the former Soviet Union have sent space probes, telescopes, and a variety of machines to the planets, moons, and asteroids in our universe. Incredible images of forming galaxies, exploding stars, red dwarfs, and supernovae have expanded our knowledge of how our universe and the planet Earth formed. We have landed on Mars and sampled the rocks and minerals of the "Red Planet." We have collected pictures of the surface of Mars and its geological formations. We have even discovered evidence that suggests there was, and maybe still is, water on Mars.