ES458/558 River Environments – Geologic Timeline Exercise

Introduction

Studying the Earth involves systematic application of the scientific method via observation, analysis and interpretation. Characteristics of geoscience that set it apart from other physical sciences include that of large-scale (planetary) spatial dimensions and extensive amounts of "deep time". Through systematic observation of rock material over the past century, geologists have arrived at the conclusion that Earth history extends back to over 4 billion years. Whereas physicists or chemists conduct "bench-scale" experiments on time periods of seconds-minutes-hours-days-weeks; geologists commonly make observations at the planetary scale involving Earth processes that have been operating for 100's of thousands to millions of years. The large dimensions of space and time make study of the Earth the ultimate "CSI" investigation that utilizes rapidly emerging technologies such as satellite observation systems and isotopic chemistry. Hence, the science of geology involves reconstructing events that operate at slow rates over long periods of time, extending well beyond the observational lifetime of any given scientist, generations of scientists, or even life spans of species.

Throughout the "River Environments" field trip, we will be making stops that involve observation of Earth materials and landforms that have developed over 1000's to 100's of thousands to millions of years. In terms of materials, there are two broad types that occur at the Earth's surface: (1) "regolith" or "unconsolidated sediment" (any material that can be excavated with a shovel) and (2) "bedrock" ("lithified" or "indurated" brittle materials that require blasting or a hammer to break apart). Both sediment and bedrock are products of the "rock cycle" involving igneous, sedimentary, and metamorphic processes. With respect to landforms, there are also two broad categories: (1) depositional and (2) erosional. Depositional landforms result from accumulation of sediment or other mineral-based materials at the Earth's surface. Examples include wind-blown sand dunes at the beach or volcanic cinder cones from magmatic eruptions. Erosional landforms result from removal of Earth material by processes that exert force (push or pull action) at the Earth's surface. Force-based "agents of erosion" include wind (moving atmospheric gas), water (flowing rivers), ice (flowing glaciers), gravitational pull (e.g. rock fall or landslides), and/or human activity (e.g. back-hoe and dump truck). A good example of a complex erosional landform is the Grand Canyon which has been formed primarily by a combination of river erosion and mass wasting (e.g. "landsliding") over millions of years. In sum, erosion results in mass transfer of Earth materials from one place to another, deposition is the end result of transportation.

Objectives and Directions

The objective of this exercise is to place the materials and landforms that we visit at each field stop in the context of geologic time. As you will quickly observe, the landscape represents a telescoping patchwork of time recorded in the bedrock, sediment, and landforms. This is an ongoing exercise that is to be completed throughout the field trip, as we visit each field locality.

Task 1 – Identify, label, and record your location at each field stop on the base map provided on the next page.

Task 2 – Key each located field stop to the "geologic timeline" tables that follow. The tables show geologic time and the epoch name in the columns at left, with spaces to record the range of geologic events that you will observe on the field trip. For each stop, provide a location ID (keyed to the base map), the geologic events recorded at the stop, and observations pertaining to the type of geologic phenomena that records the event (i.e. bedrock, sediment deposit, or landform record). For bedrock and sediment records, make observations on composition, texture, and stratigraphic patterns. For landforms, record observations on the type of feature and whether it is the result of erosion or deposition.

You will systematically complete your timeline tables on each day of the field trip. By the end of the class, you will have a comprehensive temporal summary of geologic events that we have observed in the field. This timeline summary will help you to organize your final field trip report, and will be included as one of your final portfolio products.

Time - Years Before Present	Geologic Epoch	Field Stop / Location ID:		Field Stop / Location ID:	
		Geologic Event	Geologic Record / Observations (bedrock, sediment, and/or landform)	Geologic Event	Geologic Record / Observations (bedrock, sediment, and/or landform)
0	Today				
0-200	Historic				
200-1000	Historic - Prehistoric				
1000-5000	Late Holocene				
5000-10,000	Early Holocene				
10,000-15,000	Late Pleistocene				
15,000-20,000	Late Pleistocene				
20,000-100,000	Late Pleistocene				
100,000-200,000	Middle Pleistocene				
200,000-500,000	Middle Pleistocene				
500,000-1 m.y.	Early Pleistocene				
1 m.y. - 1.8 m.y.	Early Pleistocene				
1.8 m.y.- 5 m.y.	Pliocene				
5 m.y. - 24 m.y.	Miocene				
24 m.y.-37 m.y.	Oligocene				
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