An Overview of Geomorphology

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***Abstract:* - Geomorphology is the scientific study of the origin and evolution of topographic and bathymetric features created by physical, chemical or biological processes operating at or near the Earth's surface. Geomorphologists seek to understand why landscapes look the way they do, to understand landform history and dynamics and to predict changes through a combination of field observations, physical experiments and numerical modeling. Geomorphologists work within disciplines such as physical geography, geology, geodesy, engineering geology, archaeology and geotechnical engineering. This broad base of interests contributes to many research styles and interests within the field.**

***Keywords:*- Geomorphology**

I. INTRODUCTION

Today, the study of geomorphology is broken down into the study of various geomorphologic processes. Most of these processes are considered to be interconnected and are easily observed and measured with modern technology. In addition, the individual processes are considered to be either erosional, depositional, or both. An erosional process involves the wearing down of the earth's surface by wind, water, and/or ice. A depositional process is the laying down of material that has been eroded by wind, water, and/or ice.

II. HISTORY OF GEOMORPHOLOGY

his model also says that the slope angle of the land is gradually reduced and the ridges and divides present in certain landscapes become rounded over time because of erosion. The cause of this erosion is not however limited to water as in the stream example. Finally, according to Davis's model, over time such erosion occurs in cycles and a landscape eventually morphs into an old erosional surface. Davis's theory was important in launching the field of geomorphology and was innovative at its time as it was a new attempt to explain physical landform features.

Quantitative geomorphology: Part of the Great Escarpment in the Drakensberg, southern Africa. This landscape, with its high altitude plateau being incised into by the steep slopes of the escarpment, was cited by Davis as a classic example of his cycle of erosion.

Geomorphology was started to be put on a solid quantitative footing in the middle of the 20th century. Following the early work of Grove Karl Gilbert around the turn of the 20th century, a group of natural scientists, geologists and hydraulic engineers including Ralph Alger Bagnold, Hans-Albert Einstein, Frank Ahnert, John Hack, Luna Leopold, A. Shields, Thomas Maddock, Arthur Strahler, Stanley Schumm, and Ronald Shreve began to research the form of landscape elements such as rivers and hillslopes by taking systematic, direct, quantitative measurements of aspects of them and investigating the scaling of these measurements These methods began to allow prediction of the past and future behavior of landscapes from present observations, and were later to develop into the modern trend of a highly quantitative approach to geomorphic problems. Quantitative geomorphology can involve fluid dynamics and solid mechanics, geomorphometry, laboratory studies, field measurements, theoretical work, and full landscape evolution modeling. These approaches are used to understand weathering and the formation of soils, sediment transport, landscape change, and the interactions between climate, tectonics, erosion, and deposition.

Contemporary geomorphology

Today, the field of geomorphology encompasses a very wide range of different approaches and interests. Modern researchers aim to draw out quantitative "laws" that govern Earth surface processes, but equally, recognize the uniqueness of each landscape and environment in which these processes operate. Particularly important realizations in contemporary geomorphology include:

1) that not all landscapes can be considered as either "stable" or "perturbed", where this perturbed state is a temporary displacement away from some ideal target form. Instead, dynamic changes of the landscape are now seen as an essential part of their nature.
2) that many geomorphic systems are best understood in terms of the stochasticity of the processes occurring in them, that is, the probability distributions of event magnitudes and return times.This in turn has indicated the importance of chaotic determinism to landscapes, and that landscape properties are best considered statistically. The same processes in the same landscapes do not always lead to the same end results.

Features of a glacial landscape

Glaciers, while geographically restricted, are effective agents of landscape change. The gradual movement of ice down a valley causesabrasion and plucking of the underlying rock. Abrasion produces fine sediment, termed glacial flour. The debris transported by the glacier, when the glacier recedes, is termed a moraine. Glacial erosion is responsible for U-shaped valleys, as opposed to the V-shaped valleys of fluvial origin.

The way glacial processes interact with other landscape elements, particularly hillslope and fluvial processes, is an important aspect of Plio-Pleistocene landscape evolution and its sedimentary record in many high mountain environments. Environments that have been relatively recently glaciated but are no longer may still show elevated landscape change rates compared to those that have never been glaciated. Nonglacial geomorphic processes which nevertheless have been conditioned by past glaciation are termed paraglacialprocesses. This concept contrasts with periglacial processes, which are directly driven by formation or melting of ice or frost.

Hillslope processes

Talus cones on the north shore of Isfjorden, Svalbard, Norway. Talus cones are accumulations of coarse hillslope debris at the foot of the slopes producing the material. The Ferguson Slide is an activelandslide in the Merced River canyonon California State Highway 140, a primary access road to Yosemite National Park. Soil, regolith, and rock move downslope under the force of gravity via creep, slides, flows, topples, and falls. Such mass wasting occurs on both terrestrial and submarine slopes, and has been observed on Earth, Mars, Venus, Titan and Iapetus.

Ongoing hillslope processes can change the topology of the hillslope surface, which in turn can change the rates of those processes. Hillslopes that steepen up to certain critical thresholds are capable of shedding extremely large volumes of material very quickly, making hillslope processes an extremely important element of landscapes in tectonically active areas.

On the Earth, biological processes such as burrowing or tree throw may play important roles in setting the rates of some hillslope processes. Igneous processes

Both volcanic (eruptive) and plutonic (intrusive) igneous processes can have important impacts on geomorphology. The action of volcanoes tends to rejuvenize landscapes, covering the old land surface with lava and tephra, releasing pyroclastic material and forcing rivers through new paths. The cones built by eruptions also build substantial new topography, which can be acted upon by other surface processes. Plutonic rocks intruding then solidifying at depth can cause both uplift or subsidence of the surface, depending on whether the new material is denser or less dense than the rock it displaces.

Tectonic processes

Tectonic effects on geomorphology can range from scales of millions of years to minutes or less. The effects of tectonics on landscape are heavily dependent on the nature of the underlying bedrock fabric that more or less controls what kind of local morphology tectonics can shape. Earthquakes can, in terms of minutes, submerge large areas of land creating new wetlands. Isostatic rebound can account for significant changes over hundreds to thousands of years, and allows erosion of a mountain belt to promote further erosion as mass is removed from the chain and the belt uplifts. Long-term plate tectonic dynamics give rise to orogenic belts, large mountain chains with typical lifetimes of many tens of millions of years, which form focal points for high rates of fluvial and hillslope processes and thus long-term sediment production. Features of deeper mantle dynamics such as plumes and delamination of the lower lithosphere have also been hypothesised to play important roles in the long term (> million year), large scale (thousands of km) evolution of the Earth's topography (see dynamic topography). Both can promote surface uplift through isostasy as hotter, less dense, mantle rocks displace cooler, denser, mantle rocks at depth in the Earth.

Weathering

Weathering is an erosional process that involves the chemical break down of rock (such as limestone) and the mechanical wearing down of rock by a plant's roots growing and pushing through it, ice expanding in its cracks, and abrasion from sediment pushed by wind and water. Weathering can for example result in rock falls and eroded rock like those found in Arches National Park, Utah.

III. GEOMORPHOLOGY AND GEOGRAPHY

One of the most popular divisions of geography is physical geography. By studying geomorphology and its processes, one can gain significant insight into the formation of the various structures found in landscapes worldwide, which can then be used as a background for studying the many aspects of physical geography.

Note: For great photo examples of geomorphologic processes see Professor Lisa Wells' site, Images Illustrating Principles of Geomorphology.

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