ONE APPLICATION OF MEGA-GEOMORPHOLOGY IN EDUCATION

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It has been said that those who do not learn from history are condemned to repeat it. The same can be said about people's understanding of geologic history. One advantage of a synoptic view displaying landform assemblages provided by imagery is that one can often identify geomorphic processes which have shaped the region and which may affect the habitability of the area over a human life time. Considering the continued growth of the world population and the resultant pressure and the exploitation of land, usually without any consideration given to geologic processes, it is imperative that we attempt to educate as large a segment of the population as we can abvout geologic processes and how they influence land use. I believe that space platform imagery which exhibits regional landscapes can be used 1) to show students the impact of geologic processes over relatively short periods of time (e.g. the Mount St. Helens lateral blast) 2) to display the effects of poor planning because of a lack of knowledge of the local geologic processes (e.g. the 1973 image of the Mississippi River flood around St. Louis MO) and 3) to show the association of certain types of landforms with building materials and other resources (e.g. drumlins and gravel deposits).

One way to initiate an understanding of geomorphology and landscape evolution is to introduce students to geomorphic concepts. I have taken the liberty to reproduce the 10 fundamental concepts as given by Thornbury (1969, chapt. 2) and have attemted to illustrate these concepts through the use of landform suites from space platform inagery.

1) THE SAME PHYSICAL PROCESSES AND LAWS THAT OPERATE TODAY OPERATED THROUGHOUT GEOLOGIC TIME, ALTHOUGH NOT NECESSARILY ALWAYS WITH THE SAME INTENSITY AS NOW. This statement, of course, represents a classic interpretation of uniformitarianism. The concept of uniformitarianism has come under considerable criticism over the last several years because many of the interpretations, when examined critically, are not totally valid (Shea, 1982). The statement above, for example, uses the word "laws" as though nature abides by someone's laws. Whose laws are they? And what are they? The uniformitarian concept, according to Shea, is simply the application of Occam's Razor or choosing the simplest solution. For example, to account for a given landform assemblage, the investigator should select the simplest explanation which works under our observed constraints of nature.

Landsat and other space platform imagery, which displays the broad synoptic view of the landscape, nicely illustrates the concept of uniformitarianism when applied to landform analysis.

Take, for instance, an Algerian desert scene displaying longitudinal dunes. For an exercise, have students determine what is the simplest explanation for the presence of these linear, and in places, bifurcating landforms.

2) GEOLOGIC STRUCTURE IS A DOMINANT CONTROL IN THE EVOLUTION OF LANDFORMS AND IS REFLECTED IN THEM. Virtually any image in the vicinity of a plate boundary can verify the dominant influence of geologic structure. The term "structure", however, is used by Thornbury to include variations in lithology; thus, buttes and mesas capped with a horizontal resistant unit can also illustrate this concept.

3) TO A LARGE DEGREE THE EARTH'S SURFACE POSSESSES RELIEF BECAUSE THE GEOMORPHIC PROCESSES OPERATE AT DIFFERENTIAL RATES. In homogeneous flat lying rocks, such as a thick shale formation, downcutting is dependent, in part, on the concentration of energy by the downcutting stream. The rate of downcutting will be greatest where the concentration of energy is greatest. The mere presence of a dendritic drainage pattern indicates relief. The fact that entire drainage basins can easily be shown on many Landsat images adds validity to the synoptic view approach to the study of landforms.

4) GEOMORPHIC PROCESSES LEAVE THEIR DISTINCTIVE IMPRINT UPON LANDFORMS, AND EACH GEOMORPHIC PROCESS DEVELOPS ITS OWN CHARACTERISTIC ASSEMBLAGE OF LANDFORMS. This possibly, more than any other concept, can be best substantiated with the use of space platform imagery and large landform assemblages. For example, compare the nature of drainage patterns and valley development in a fluvial-dominated system with that of a glacial-dominated system. The glacial valleys tend to be broad and stubby compared to the fluvial valleys, thus, reflecting the nature of glacial erosion.

5) AS THE DIFFERENT EROSIONAL AGENTS ACT UPON THE EARTH'S SURFACE, THERE IS PRODUCED AN ORDERLY SEQUENCE OF LANDFORMS. This concept is most applicable over cyclic time as defined by Schumm and Lichth (1965); however, the orderly or systematic change from one type of landform to another can be shown in Landsat images which display pediments and inselbergs from the Basin and Range Province.

6) COMPLEXITY OF GEOMORPHIC EVOLUTION IS MORE COMMON THAN SIMPLICITY. This concept can be easily exhibited with space imagery in mountainous regions such as the Zagros Mountains of Iran, where structure, lithology, salt diapirs, weathering, mass wasting and fluvial processes meld to produce a complex topography.

7) LITTLE OF THE EARTH'S TOPOGRAPHY IS OLDER THAN TERTIARY AND MOST OF IT IS NO OLDER THAN PLEISTOCENE. Of all the concepts listed by Thornbury, this one is probably the most difficult to demonstrate through the study of mage-landforms as viewed on space imagery. If students have a good grasp of geomorphic

processes and variations in their intensity as they alter the landscape, then the concept is not difficult to visualize. Images which show sand seas, deltas or expanding drainage basins can be used to demonstrate this concept.

8) PROPER INTERPRETATION OF PRESENT-DAY LANDSCAPES IS IMPOSSIBLE WITHOUT A FULL APPRECIATION OF THE MANIFOLD INFLUENCES OF THE GEOLOGIC AND CLIMATIC CHANGES DURING THE PLEISTOCENE. This concept can be appreciated when one is confronted with accounting for glacial valleys, horns and cirques in an area now dominated by fluvial, weathering and mass wasting processes. Scenes from the Southern Rocky Mountains can illustrate this concept.

9) AN APPRECIATION OF WORLD CLIMATES IS NECESSARY TO A PROPER UNDERSTANDING KOF THE VARYING IMPORTANCE OF THE DIFFERENT GEOMORPHIC PROCESSES. The Niger River in central Mali and the associated vegetated sand dunes indicate clearly that there has been a climatic change in the not so distant past.

10) GEOMORPHOLOGY, ALTHOUGH CONCERNED PRIMARILY WITH PRESENT DAY LANDSCAPES, ATTAINS ITS MAXIMUM USEFULNESS BY HISTORICAL EXTENSION. A comparative study of the earth with other planets can be a fruitful exercise when one realizes that the early earth's crust must have resembled the present day moon about 4.2 billion years ago.

This is not an all inclusive list of important geomorphic concepts nor is the importance of the above concepts equal, but with the use of space imagery and the analysis of mega-landform suites included within the imagery, a fruitful and lively discussion can ensue. If students can appreciate and understand these and other concepts of geomorphology and then apply them positively so as to avert some natural disaster when dealing with man's seemingly endless focus to dominate nature, then at least modern space technology has not been developed in vain.

REFERENCES CITED

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