gravel in deep-sea valleys so far from continents. The data indicate that most submarine canyons and deep-sea valleys are relicts, formed at earlier times, not evolving on a daily basis.

Conclusion

The data of geology directly challenge the theory that the earth's landscapes slowly evolved to their present configuration. Instead, a catastrophic view for the origin of landscapes seems most reasonable. Could the landforms of earth include many features related to widespread flooding and glaciation? Such an interpretation seems most natural. Steady evolution? — No!; Catastrophe? — Yes!

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...If you call out for **Insight...**
You will understand the fear of the LORD and find the knowledge of God.
Based on Proverbs 2:3-5

No. 118
April 1983

Did Landscapes Evolve?

by Steven A. Austin, Ph.D.

The most popular theories for the origin of the form of the earth's surface features suppose that they have been sculptured during vast time periods by erosive processes similar in rate, scale and intensity to modern processes. The theory that dominates modern geomorphology was formulated nearly a hundred years ago by William Morris Davis,[1] a Harvard geologist. He supposed that landscapes did not develop haphazardly, but evolved through a series of stages as the stream drainage slowly eroded channels upslope and as valleys were progressively widened and deepened. According to Davis, the "youthful" stage of landscape evolution immediately follows uplift and is characterized by poor drainage, and narrow, V-shaped valleys between flat and wide interstream divides. After a few millions of years of erosion, the maximum relief "mature" stage would be achieved with well-integrated stream drainage, and deep, wide valleys, between narrow and rounded interstream divides. Finally, if erosion continued unchecked, the landscape could enter the "old age" stage where the surface becomes a poorly drained "peneplain" with streams of low gradient meandering over extensive flood plains at elevations just above sea level.

Although there have been occasional questions as to details of Davisian theory, geomorphologists have manifested intense fascination with the notion of landscape evolution. It satisfies some evident needs of some scientists. Davis' system follows the concepts of organic development which also swept the scientific community in the late nineteenth century (even the stages "youth," "maturity" and "old age" correspond nicely with organic evolution!). Furthermore, the simplicity and attractiveness of the system lend it well to teaching. The most popular laboratory manual currently used in American undergraduate geology courses[2] presents only the Davisian idea that landscapes have evolved.

The basic issue crucial to assessment of the merits of evolutionary theories for the origin of landscapes is whether the landforms we observe today have had any permanence. According to Davisian theory (and other, similar theories), the entire land surface has changed its form slowly and continuously over long periods of time. Davis, for example, supposed that the angle of a slope would decrease as an uplifted area was slowly eroded with the landform changing shape until a low-relief plain near sea level was produced. In short, Davis' view is that landscapes are transient features having no permanence: they have evolved. All features of the earth's surface are viewed by the Davisian system as being at various stages along a continuum of change.

An alternate idea is the non-evolutionary or what might be called the catastrophic theory for the origin of landscapes. Instead of being the products of long continued processes operating at essentially modern rate, scale and intensity, landscapes could be remnants formed by catastrophic processes which acted at significantly increased rate, scale and intensity above what we observe today. The ancient processes which formed the landscape would be discordant with modern processes acting on that landscape; no continuum of change and no stages of evolution would exist. Modern erosion processes would be viewed as entirely destroying an ancient landscape, not transforming it from one equilibrium stage to another. Such a landscape would contain relict landforms, surface features which were created by erosional or depositional processes no longer acting. Relict features on the earth's surface would make the landscape appear as a "museum," and such features, in contrast to the Davisian system, would have a great degree of permanence.

It is not well appreciated, but nevertheless true: evolution of landscapes has simply been assumed, not proved. The non-evolutionary or catastrophic theory has largely been spurned or ignored by the majority of geomorphologists, as the catastrophists were supposedly refuted more than a hundred years ago. Now with the recent rebirth of interest in catastrophe[3] as an important element of geomorphology the alternate landscape theory needs to be considered.

Elevated Paleoplains

According to evolutionary theories for the origin of landscapes, elevated plains should be rapidly incised by erosion and bear a well-developed drainage system in only a few millions of years. Elevated, low relief land surfaces, therefore, should be evidence of the "youthful" stage of landscape evolution, while low-lying, low relief surfaces ("peneplains") might indicate the "old age" stage. C.R. Twidale,[4] a physical geographer from Australia, argues that remnants of old paleosurfaces of low relief (what he calls "paleoplains") constitute an important part of many contemporary landscapes in various parts of the world. Some of these elevated paleoplains are assigned "Jurassic" or even "Triassic" ages (approximately 200 million years in the evolutionary-uniformitarian estimates of age).[5] Examples of elevated paleoplains include the enormous Gondwana Surface of southern Africa (a large part of which has been assigned a "Cretaceous" age)[6] and various paleoplains of central and western Australia (some of which has been assigned probable "Triassic" age).[7] L.C. King[8] believes that these paleoplains were formed by erosion due to sheet flooding of the surface (the "pediplain" idea). Today they are being destroyed by downcutting erosion in stream channels.

What is amazing is that these plains have survived without major stream channel erosion. Twidale says, "The survival of these paleoforms is in some degree an embarrassment to all the commonly accepted models of landscape development."[9] He notes that the Davisian theory offers "no theoretical possibility for the survival of paleoforms,"[10] and marvels at the "ample time for the very ancient features preserved in the present landscape to have been eradicated several times over."[11]

Underfit Streams

Evolutionary theories for the origin of landscapes assume near constancy of discharge of streams and a steady rate of erosion as a landscape evolved. It is with interest that we look at stream and river valleys for evidence of ancient water flow rates. Studies by G.H. Dury[12] on modern stream channels and river valleys prove that many are too large for the streams that they contain. He argues that most modern streams at some point on their channel are "underfit." Dury speaks of the "continent-wide distribution of underfit streams."[13] Using channel meander characteristics, Dury concludes that streams frequently had 20 to 60 times their present discharge.

H.F. Garner[14] calls our attention to examples from all continents of dry channels associated with underfit streams which once carried surges of flood waters. Evidence is found in relict channel labyrinths along the Mississippi River in eastern Missouri, in the central Sahara south of Tibisti, in the sculptured terrain of Wright Dry Valley, Antarctica, and in the scabland of eastern Washington State. The anastamosing channels of eastern Washington are now believed to have formed by floods which more or less simultaneously inundated 10,000 square miles with water to a depth of as much as 400 feet.[15] The enormous dry channels, giant waterfall scars and colossal boulder and gravel bars of eastern Washington are relict landforms not forming by extant processes along the present Columbia River.

Submarine Canyons And Deep-Sea Valleys

Evolutionary theorists for the origin of landscapes also suppose that ocean floor topography evolved. The continental slope around the submerged margins of all the continents is often cut by incisions, ravines and valleys, the most spectacular of which are submarine canyons. Like their counterparts on land, submarine canyons usually have dendritic pattern, steep walls, sinuous valley, and V-shaped cross-section. Some submarine canyons are associated with the mouths of large rivers (e.g., the Congo, Columbia, Hudson and Rhone rivers), and serve as conduits for transport of terrigenous sediments from continents to the deep ocean basin. Most canyons, however, are not associated with the mouths of modern rivers, and some are not even on the continental margin, but occur around islands. The Great Bahama Canyon in the Bahamas appears to be the world's deepest canyon (depth 14,000 feet, width 40 nautical miles, length 125 nautical miles) being more than twice the size of the Grand Canyon!

Even more amazing are the deep-sea valleys found on the floors of all the major oceans. These can be traced across thousands of miles of deep-sea floor and are known to contain sediment as coarse as gravel moved unimaginable distances from presumed continental sources.

The Origin of submarine canyons and deep-sea valleys has long-puzzled marine geologists. What process or processes could erode such canyons and valleys so far below sea level? F.P. Shepard, who has studied submarine canyons and valleys for more than 50 years, can make few definite statements about their origin.[16] His book leaves the origin of submarine canyons and valleys a major unsolved mystery.[17] Turbidity currents, episodic, aqueous gravity flows on the sea floor, may explain the major mode of sediment transport, and possibly some canyon erosion, but such phenomena would be required on an extremely catastrophic scale to explain the