9. DRAINAGE PATTERNS

(A discussion)

Streams and rivers often follow unexpected patterns that do not seem to reflect topography. In the Middle Rocky Mountains, major rivers such as the Green River cut through the Uinta Mountains instead of going around their end only a few dozen miles to the east. Any intelligent river would be expected to go around, and not "over" the Uintas. That is not what the Green River has done. It has cut a gorge over 600 m (2000ft) deep through the Uintas. The Colorado River has cut perpendicularly through the Fisher and Moab Valleys and then it cuts a mile down through the Kaibab Upwarp to form the Grand Canyon. This pattern is also well represented in other continents of the Earth. Several models have been used to explain these unusual features. Some pertinent concepts will help you understand proposed models.

A river system that follows a normal downhill pattern along a pre-existing land surface is said to be **consequent** (the consequence of original slope). This pattern can be altered by mountain uplift, erosion around resistant rock units, etc. When altered, this is called **subsequent** (subsequent to the original pattern). Occasionally a river may erode its bed into the path of another and capture it. This is called **stream capture** or **piracy**. When this happens, the downstream portion of the captured river dries up and is said to be **beheaded**.

The case of rivers cutting right through mountain ranges is especially intriguing. Two models have been given serious consideration. The first, called **antecedent**, postulates that the river has stayed more or less in its original position as slow uplift of the region has taken place (compare Diagrams A and B under "Antecedent" in Fig. 21). As long as uplift is slower than the erosional capability of a river, the river can maintain its normal position and grade (slope) across uplifting regions. Its position being antecedent to uplift, the sequence is appropriately referred to as antecedent drainage. The river Arun, which crosses the Himalayas a few dozen km east of Mount Everest through deep and almost impassable gorges, is considered to be antecedent (Sparks 1986, pp. 157-159).

The second model to explain rivers cutting through mountain ranges is called **superposed**, a contraction of "superimposed." In this model the pattern of a river from a higher level is superimposed on the present topography. The mountain ranges are assumed to have already been there but buried in sediments (see Fig. 21, Diagram A, under "Superposed"), and the rivers flow on the surface of the sediments that cover these ranges. The sedimentary layers over and around the mountain ranges are then eroded with time, and the river cuts down through them including the buried ranges (see Diagram B under "Superposed", which is the same as Diagram B under "Antecedent'). With either model one ends up with the same final result. This makes it more difficult to tell which really occurred.

Early geologists studying the Middle Rocky Mountains thought the rivers were antecedent. Later workers, finding remnants of former alluvium (stream deposition) high on mountain sides, have given preference to the superposed model (Bloom 1978, p. 275). In general superposition is given preference over antecedence, the latter being considered a "last resort" (Sparks 1986, p. 156) because of difficulty in authentication. On the other hand, one has some difficulty in envisioning enough of a sedimentary volume to fill up all the space between mountain ranges as suggested for superposition.

The superposed model can be fit into a flood model just as easily as the antecedent one, or even more so. Major sediment removal accompanied the receding "superimposed" flood waters, and rivers entrenched themselves even through mountain ranges as the drainage of the continents continued.

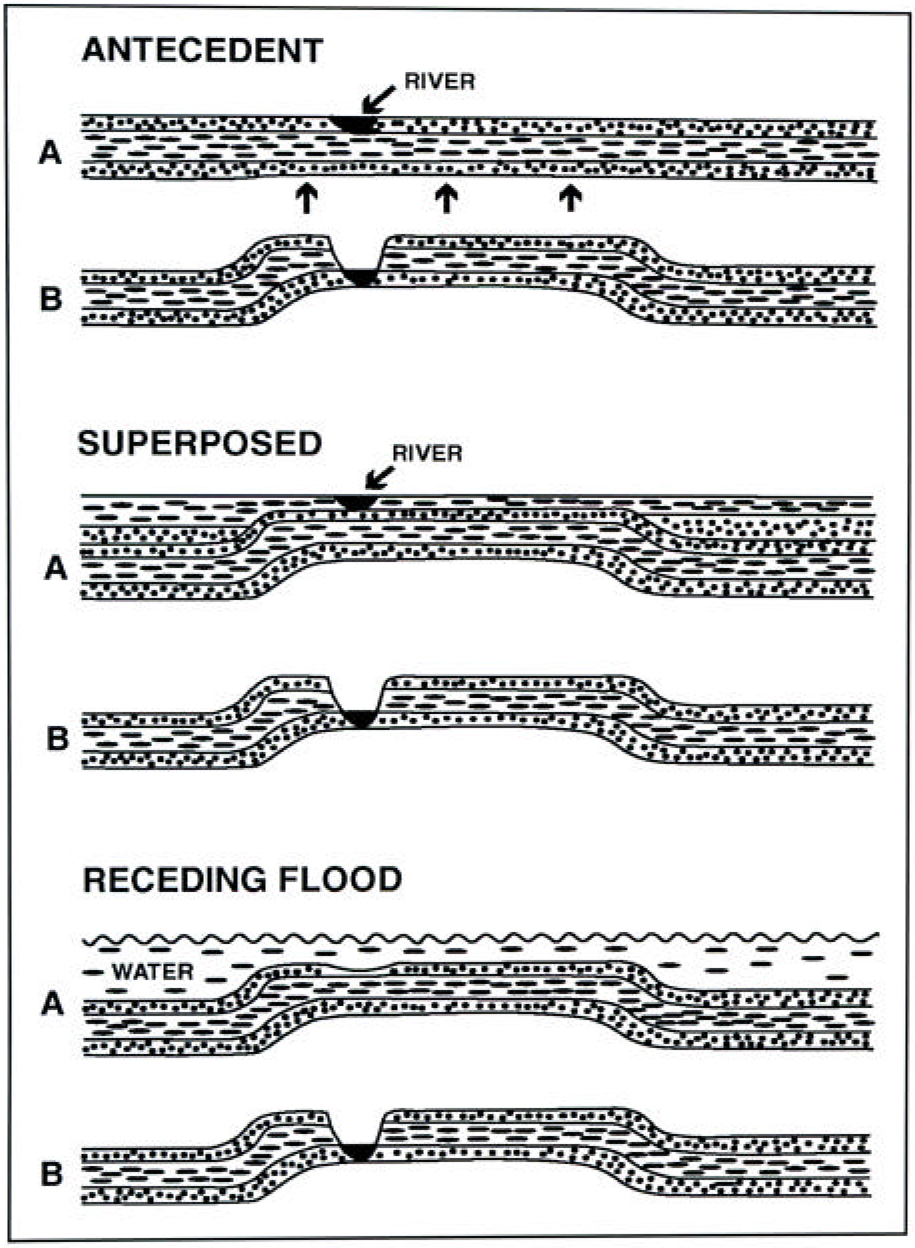

FIGURE 1. Drainage patterns.

In the context of a creation-flood perspective a third pattern can also be considered, namely that the overlying flood waters could cut through these mountains as they drained a particular region (Fig. 21, receding flood pattern). The rapidly flowing waters of a receding flood could rapidly cut deep gorges through mountain ranges as these waters sought lower elevations. In varied situations, especially when under water, it would be easier for the overlying waters to proceed through an incipient gorge and deepen it than to go all the way around a range. Such a pattern could mitigate the problems of the slow uplift required for the antecedent model and the necessity of sediments to support a high river bed in the superposed model. In the context of a creation-flood model, all three patterns and others could be involved. The receding flood pattern can explain the enigma of the huge side canyons, especially on the north side of the Grand Canyon, that have no source of water to erode them.

Under the conditions expected during the receding of the waters of the Genesis Flood, the assumed time imposition that uplift has to be slower than the expected erosional capability of a river is not very restrictive. Rapid erosion could take place as raging waters would drain off the continents. Of interest is the increase in transporting capacity of rivers as their velocity increases. Holmes (1965, p. 512) points out:

> *The transporting capacity of a stream rises very rapidly as the discharge and velocity increase. Experiments show that with debris of mixed shapes and sizes, the maximum load that can be carried is proportional to something between the third and fourth power of the velocity.*

This means that if the velocity (speed) of the river is increased ten times, it can carry between 1000 and 10,000 times as much sediment.

The abundance of rivers that cut through mountain ranges over the earth strongly suggests a past quite different from the present. The receding waters of the Genesis Flood provide a reasonable and simple explanation for this.

REFERENCES

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