tionary mechanism has been clarified. Evolution means primarily an increase in the content of information in the case of DNA, but natural selection means only the elimination of error in information or mutation (in the most favorable case, only a modification of the information), not an increase in the quantity of information. Correcting a misspelled word or substituting one word for another is after all something quite different from writing down a sentence, an article, a whole book.

It would seem to me premature to reject the clear account of Genesis in favor of this theory. The evidence is not so overwhelming that reason insists on this approach.

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THE MYSTERY OF THE RED BEDS

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The extensive formations, canyons and erosion of the Colorado Plateau region are described and illustrated. Succession of these sedimentary rocks and their lithology is presented with notation of their great 200,000 square mile expanse. The relative lack of erosion at the various horizons in comparison with the amount that has occured on the PRESENT *surface of the plateau is used to argue for a relatively short period of time for their formation. A general lack of sources for these vast deposits of sandstone, shale and conglomerate is shown as being critical to a satisfactory explanation of them from the viewpoint of uniformitarianism. Conclusions are (1) sediments were brought in from great distances (2) great sweeps of water instead of local river or flood action were necessary to spread out these sediments over this vast area, and (3) the various formations were laid down one after the other in rapid succession.*

Probably nowhere else in America are to be found more interesting and puzzling displays of rocks than in the Colorado Plateau region, which covers more than 200,000 square miles in Utah and portions of surrounding states. For a number of years I have made observations here and there in the region, and have covered it quite thoroughly, I have also read widely in the literature dealing with the region, and this paper is the result of these travels and studies. The points presented will, I hope, be of value in interpretation of geology from the viewpoint of the Flood.

The accompanying figures, showing the relation of the strata over this region, have been prepared from various publications, from private

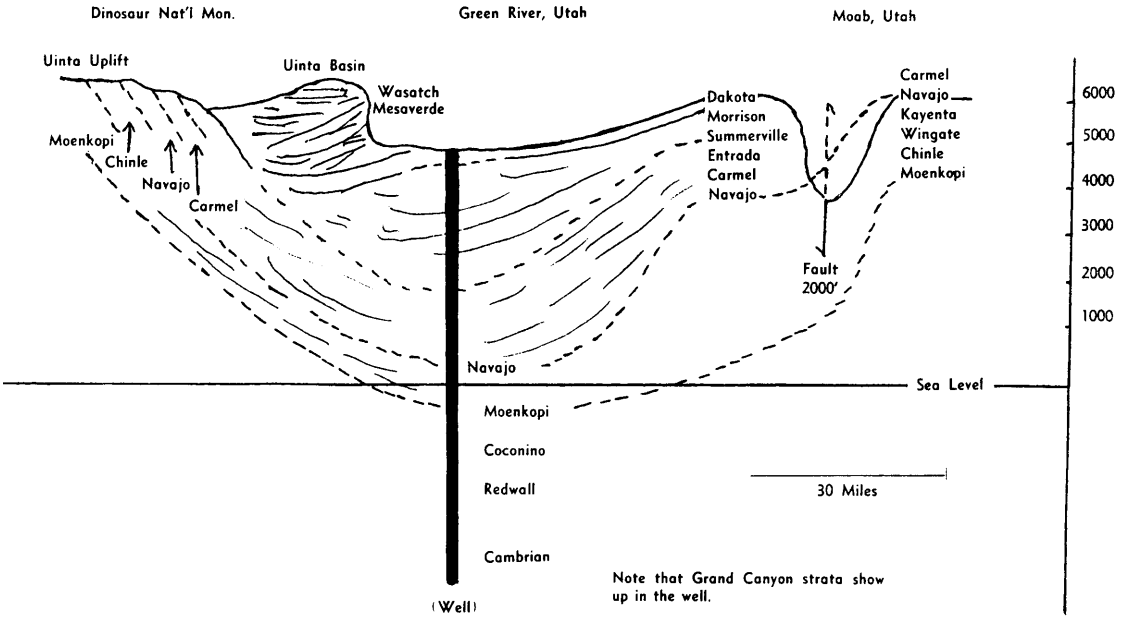

Fig. I Section from Moab, Utah, North to the Dinosaur National Monument, showing the dip into the Uinta Basin, and the uptilted strata on the southern flank of the Uinta Mountains.

correspondence, and from data obtained from the office of the Pure Oil Company at Moab, Utah. Reference to these should be made as the article is read, in order to follow the data to its logical conclusion.

A visitor to the Grand Canyon stands in awe as he gazes almost a mile straight down past layer after layer of rock that has been carved by the swift-running Colorado River. At the bottom the inner gorge cuts through over a thousand feet of crystalline rocks, These rocks are classified as pre-Cambrian, and are supposed by the geologists to represent the very earliest rocks of the earth, laid down, according to popular theory, before the fossiliferous rocks were deposited.

The most striking feature of the canyon is probably the massive cliffs that are formed by the erosion of the limestones and red sandstones. Then, near the top is the spectacular white Coconino sandstone, with the grayish Kaibab limestone capping the north rim, (The left-hand column of the chart gives the classification of these strata.) We must remember that while we may not agree with the geologists as to the "age" of these rocks, we must recognize that the rocks do occur in a certain sequence.

When we go northward from the Grand Canyon, either to the east or the north, we find more red beds spread out everywhere, with beautiful carved cliffs, monuments, and canyons. Wells in the Kanab Valley, about 75 miles north of the north rim, penetrate many of the same formations that are exposed on the walls of the canyon. It is important to note that the Moenkopi formation, which in these wells lies directly on top of the Kaibab, is exposed at some distance away, both to the east and the west. It forms the floors of the valleys just south of Zion National Park.

CHART OF PRINCIPAL FORMATIONS OF THE COLORADO PLATEAU

TERTIARY	WASATCH	
CRETACEUS	MESAVERDE	
	MANCOS	
	DAKOTA	
JURASSIC	MORRISON	
	SUMMERVILLE	
	ENTRADA	
	CARMEL	
TRIASSIC	NAVAJO	GLEN CANYON GROUP
	KAYENTA	GLEN CANYON GROUP
	WINGATE	GLEN CANYON GROUP
	CHINLE	
	SHINARUMP	
	MOENKOPI	
PERMIAN	KAIBAB	
	COCONINO	
	HERMIT	
	SUPAI	
MISSISSIPPIAN	REDWALL	
CAMBRIAN	MUAV	
	BRIGHT ANGEL	
	TAPEATS	
PRE-CAMBRIAN	GRAND CANYON SERIES	
	VISHNU	

(Note: Often boundary line between Triassic and Jurassic is indistinct locally.)

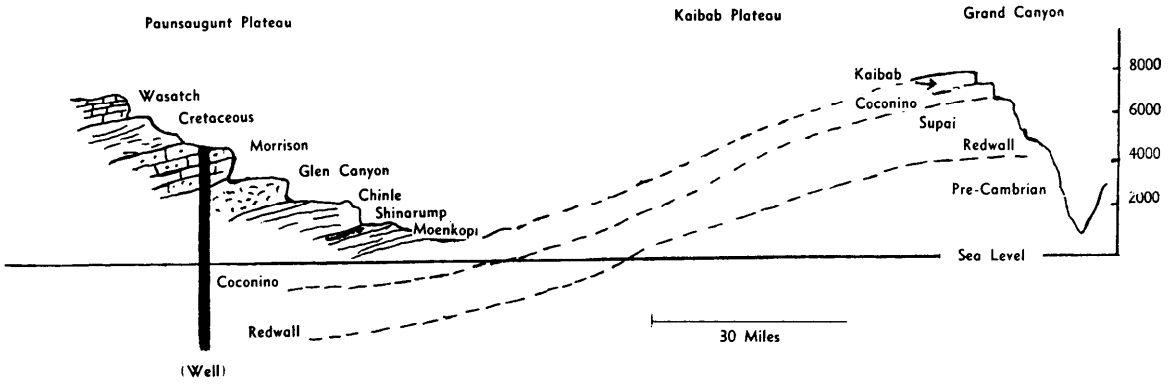

Fig. 2 Section north from the Grand Canyon, showing relation of Grand Canyon strata to formations of higher stratigraphic sequence.

Rising above the Moenkopi we find a succession of beautiful beds, which are prominently displayed over much of central Utah. Then, farther to the north and east, others appear above them, until we reach the highest members of the series in the Uinta Basin in northern Utah.

Several Questions Generated

Questions arise as we examine the lateral distribution of these beds. From northern Arizona to southern Wyoming, between 400 and 500 miles, and from eastern Nevada to central Colorado, 400 to 500 miles across, this great Colorado Plateau appears to be one of the greatest sedimentary basins in the world, Estimates of the amount of material deposited here before erosion washed any of it away, run as high as a million cubic miles, and in some cases, even more. What a movement of rock-forming sand must have

Where did it all come from? And by what means did it get there? These are simple questions, but the answers involve some of the most profound mysteries of the past. Let us examine these rocks somewhat in detail.

Perhaps the best location where we can begin our investigation is near the little city of Moab, in eastern Utah. Here, rising 2000 feet above the Colorado River, are the beautiful red and brown cliffs classified as Triassic and Jurassic. About 50 miles north of Moab the Cretaceus Book Cliffs arise, and we note that they lie on top of the rocks that are exposed around Moab.

If we go to the Colorado National Monument near Grand Junction, Colorado, we find the same red beds we see near Moab, and across the valley to the north the gray Cretaceus cliffs rise above the Jurassic. Farther north we can catch glimpses of the Tertiary rocks. There before our eyes are spread out between 4000 and 6000 feet of strata in regular succession.

Coming back to Moab, let us study the formations exposed on the cliffs. Their names are as follows:

- Triassic
  - Glen Canyon Group
    - Navajo
    - Kayenta
    - Wingate
  - Chinle
  - Shinarump
  - Moenkopi

The Kaibab and Coconino formations of the Grand Canyon rocks lie only a few hundred feet below these cliffs, but do not come to the surface.

The Moenkopi formation generally consists of up to 500 feet of red and brown mudstones, sandstones, or shales, and it weathers to form brilliant slopes. In some places it is much thicker. It contains very few fossils, but what are found lead to the conclusion that these beds were mostly of continental origin, not marine.

The Moenkopi underwent structural warping before the overlying sediments were laid down upon it. Yet no deep canyons appear anywhere. The next higher formation, the Shinarump, was dropped into shallow hollows of the Moenkopi. These hollows are generally not over 40 feet in depth, sometimes more, and in many places much less. We are puzzled as to how geologists can believe that millions of years could be involved in these processes without leaving deep canyons instead of shallow hollows.

The Shinarump is a very peculiar type of rock. It is a hard, resistant sandstone containing many small pebbles. This combination forms what we call a conglomerate. The pebbles are well rounded, showing that they have been washed for great distances. They are usually less than two inches in diameter, and are composed of quartzite, chalcedony, and flint, in various colors. Eighty per cent of those over one-fourth of an inch in diameter comes from rocks not represented in the plateau.

Questions About Origin of Rocks

Where did these pebbles come from? If they had been produced by normal processes, the underlying Moenkopi rocks should have formed the landscape from which streams would wash out material to form the Shinarump deposits. The fact that the Shinarump is spread out so widely and so thinly makes it practically impossible to explain it by any normal local actions. The situation would seem to demand rapidly moving water on a tremendous scale.

The Shinarump grades into the Chinle, so that the distinction between the two is hard to make. The Chinle consists of mudstones, shales, sandstones, and conglomerates. These various rocks intergrade. They show considerable irregularity in local bedding, as if strong streams and whirling waters had dumped their loads into shallow bodies of water. This "delta" bedding is also true of the Moenkopi. Fossil wood occurs in "log jams," which is another indication of flood-plain or delta conditions with rapidly running water.

The Glen Canyon group, lying above the Chinle, consists of rocks very similar to the ones just described. In some cases cuts of 15 to 20 feet have been made before the next layers were deposited, but beyond these slight irregularities no special signs of erosion can be seen. Wherever exposed, these rocks form cliffs from 700 to 1000 feet high.

On the east side of the highway, about five miles north of Moab, another group of rocks lie exposed in the Arches National Monument. These are classified as follows:

Jurassic { Morrison, Summerville, Entrada, Carmel

Due to a fault, the Carmel, which normally lies on top of the Navajo (the top layer on the west side of the valley) is brought down to the level of the valley; and so as we go eastward into the Monument, we can follow the Jurassic series upward to the Cretaceus.

The Carmel is from 125 to 150 feet thick, and consists of pink to red or brown sandstones and mudstones, irregularly bedded. On top of it lie 250 or more feet of Entrada, a massive reddish-brown sandstone. The Summerville is less than 50 feet thick, and varies in composition. In some areas it contains great masses of agatized or opalized material.

One of the most outstanding formations in the region is the Morrison, which crops out a few miles to the north and east. This has many variations,–sandstone, conglomerate, etc., similar to the Shinarump, also limestones of various colors, mudstones, and quartzite. (Note: A formation is not necessarily uniform in composition; its unitary structure is determined by its stratigraphical position and fossil content rather than by its lithographic composition.)

The Morrison has been traced for more than 100,000 square miles, and is nowhere more than 400 feet thick. It shows up as far east as Oklahoma and North Dakota. Geologists say it appears to have been laid clown by rivers sweeping over extensive flood plains.

Above the Morrison lies the Dakota, a Cretaceus formation similar to the Morrison in superficial structure, but made up largely of sandstones and clays.

The Tertiary formations of the Uinta Basin are interesting, but are outside the problems we are considering in this paper. Note, however, that the lower strata crop out from beneath them on the flanks of the Uinta Mountains uplift.

Evaluation of Data

Now what conclusions can we draw from these facts? Let us try to evaluate the data and see what generalizations are possible.

Of course the first idea to propose would be that the materials forming these beds had been washed down from nearby highlands and deposited in an ancient sea, But where were these highlands? Not the Rockies nor the Wasatch nor the Uintas nor the La Sals, for all these great mountain regions were pushed up after most of the sediments of the Colorado Plateau were laid down. They are uplifts and intrusives that have been forced up from deep down, and have warped and twisted and inclined the overlying sediments as they arose.

Only one local area seems to have contributed much of the rocks of the basin, and that is the Uncompaghre Plateau, a mass of granite rock lying in southwestern Colorado. But what it gave could have involved only the lowest of the beds, the gray marine rocks of the strata below the red sands. Later much of this overlying material was removed, but today remnants still remain on top of the granite in some places.

Geologists are able, by examining the thickness and texture of the rocks, to tell from what direction they have been derived. In the case of the Colorado Plateau, most of the sandstones are believed to have come from the west or southwest. In some areas the formations are much thicker on the west than on the east; they thin out to the eastward. Also, as we go eastward, the materials become finer and finer. These facts show clearly that the sediments came from the west.

Of course there are local variations. One of the most recent reports on the region describes supposed ancient "seas" into which sediments

were washed from the east. But this is not the general rule, although a certain amount of back and forth washing might be expected in any case, whether we interpret the situation in terms of "ages" or of Flood stages.

Studies of areas farther west fail to reveal the source of the sands. Central Nevada contains as much as 15,000 feet of the lower marine sediments, but there is nothing there that could have supplied the red sands. The conclusion seems almost inevitable that an ancient continental mass in the vicinity of California or the eastern Pacific must have been the source.

There is a possibility that some of the material may have come from the southwest, as some of the granites of Arizona contain particles of iron, which might furnish coloring material and sand. But this is only a speculation; we do not have enough information to make an effective point of it.

A striking fact that supports the conclusion that the sands came from a long distance away is the remarkable evenness of deposition, with very little erosion such as goes on today. How beds of sandstone, mudstone, and shale could have been exposed to the atmospheric elements for millions of years and yet show no canyons or deep gorges such as recent times have produced, is a mystery.

Geologists sometimes postulate millions of years of exposure to the elements until a peneplain (a perfectly smooth plain) is formed before another layer is deposited. This explanation cannot apply here, for, as we have pointed out, the formations very commonly blend one into the other, as if their deposition had been continuous.

Had the Shinarump and Chinle deposits, for example, been derived from a landscape of Moenkopi rocks, the latter would have had to be elevated so as to furnish materials to supply these beds. There is no sign that that has happened. Everywhere the Moenkopi underlies them. How could the Shinarump and Chinle have been derived from the Moenkopi? This general principle holds good for almost any two consecutive beds. None of the layers of sandstone below the Morrison limestone, for instance, could have furnished material to build up this great formation. The material had to come from a distance.

As one studies the cliffs, even though they expose a supposed 70,000,000 years of deposit, nowhere do they show land masses, mountain ranges, badlands, river-carved canyons, or beach lines such as might be expected in the normal course of events. Look at what has happened in this region today; even if we allow the time lapse accepted by popular geological theory, not over a million years would be involved. And yet in that time (if we allow it, for the sake of argument), tremendous cutting and washing has taken place, the like of which seems to be entirely lacking in the cliffs themselves.

Furthermore, even with the great amount of cutting that has recently taken place, nothing has occurred that would spread materials such as conglomerates over a hundred thousand square miles. The action that laid those cliffs down was of a nature completely different from what was going on when they were carved into their present contours.

One more peculiar fact should be noted. Several of these successive formations are very similar, in fact, so nearly identical in composition and appearance that it is difficult to identify them unless we can follow through their sequence. In one locality the great cliffs are made of Wingate, in another Navajo, in another Entrada. There is an alternation of massive sandstone repeatedly, as also of other materials. How this could have happened over 70,000,000 years of time is very hard to understand.

Conclusions

After all the evidence has been considered, several obvious conclusions seem to be justified: (1) that the sediments have been brought in from great distances, not from local sources, (2) that they were brought in by great sweeps of water, for no ordinary river could spread them out as they are, and (3) that they were laid down one after the other in rapid succession, with no long periods of erosion between. On what other basis can we reasonably explain the evenness of the contours between formations, the irregular bedding within them, and the alternate occurrence of the massive sandstones and conglomerates?

All in all, as we study this region and try to build a picture of how the deposits have been made, we are impressed that a new approach needs to be made to geological interpretation. The current theories were proposed a century and a half ago, when very little detailed observations had been made. On the basis of these meager observations great areas have been interpreted. But the present theories are definitely inadequate to explain what we find in this vast and colorful region.

On the other hand, the facts may be fitted effectively into the Deluge interpretation. The great universal Flood, with its world-wide sweep of waters rising higher and higher and engulfing the ancient world and spreading its rocky materials far and wide, is a far more satisfactory answer to geological problems that the theory of ages of slow, normal sedimentation.

How long will it be before serious scientific consideration is given to the Flood? It is high time that we give it a place in modern thought.