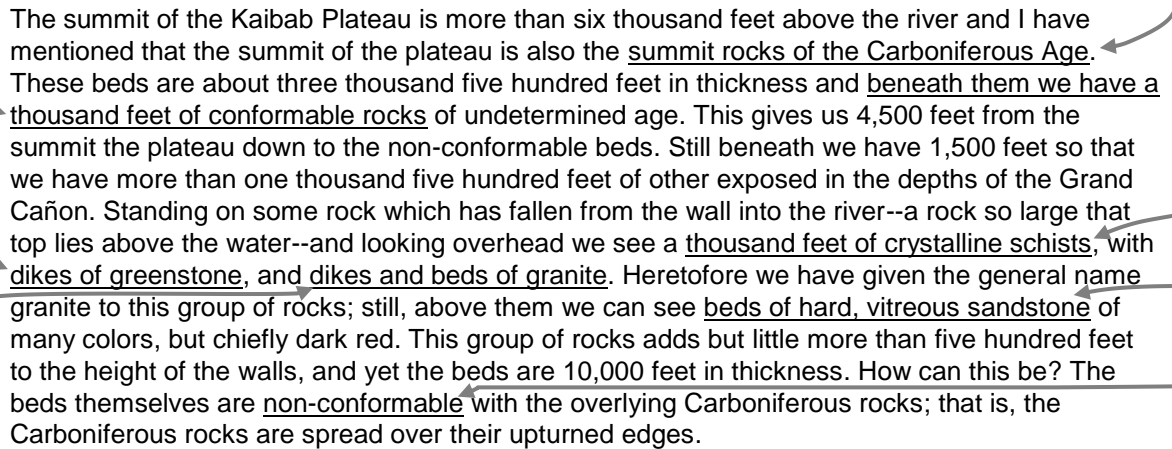


Excerpt from
Exploration of the Colorado River of the West and Its Tributaries
by John Wesley Powell, 1875.
To accompany Activity 11.10

RECORDS OF MORE ANCIENT LANDS



The summit of the Kaibab Plateau is more than six thousand feet above the river and I have mentioned that the summit of the plateau is also the summit rocks of the Carboniferous Age. These beds are about three thousand five hundred feet in thickness and beneath them we have a thousand feet of conformable rocks of undetermined age. This gives us 4,500 feet from the summit the plateau down to the non-conformable beds. Still beneath we have 1,500 feet so that we have more than one thousand five hundred feet of other exposed in the depths of the Grand Cañon. Standing on some rock which has fallen from the wall into the river--a rock so large that top lies above the water--and looking overhead we see a thousand feet of crystalline schists, with dikes of greenstone, and dikes and beds of granite. Heretofore we have given the general name granite to this group of rocks; still, above them we can see beds of hard, vitreous sandstone of many colors, but chiefly dark red. This group of rocks adds but little more than five hundred feet to the height of the walls, and yet the beds are 10,000 feet in thickness. How can this be? The beds themselves are non-conformable with the overlying Carboniferous rocks; that is, the Carboniferous rocks are spread over their upturned edges.

In Illustration 79 [our Figure 11.3] we have a section of the rocks of the Grand Cañon. A, A represents the granite; a, a, dikes and eruptive beds; B, B, these non-conformable rocks. It will be seen that the beds incline to the right. The horizontal beds above, C, C are rocks of Carboniferous Age, with underlying conformable beds. The distance along the wall marked by the line x, y, is the only part of its height represented by these rocks, but the beds are inclined and their thickness must be measured by determining the thickness of each bed. This is done by measuring the several beds along lines normal to the planes of stratification; and, in this manner, we find them to be 10,000 feet in thickness.

Doubtless, at some time before the Carboniferous rocks C, C were formed, the beds B, B extended off to the left, but between the periods of deposition of the two series, B, B and C, C there was a period of erosion. The beds, themselves, are records of the invasion of the sea; the line of separation the record of a long time when the region was dry land. The events in the history of this intervening time, the period of dry land, one might suppose were all lost. What plants lived here, we cannot learn; what animals roamed over the hills, we know not; and yet there is a history which is not lost, for we find that after these beds were formed as sediments beneath the sea, and still after they had been folded, and the sea had left them, and the rains had fallen on the country long enough to carry out ten thousand feet of rocks, the extension of these beds to the south, which were cut away, and yet before the overlying Carboniferous rocks were formed as sediments of sand and triturated coral reefs, and ground shells and pulverized bones, some interesting events occurred, the records of which are well preserved. This region of country was fissured, and the rocks displaced so as to form faults, and through the fissures floods of lava were poured, which, on cooling, formed beds of trap, or greenstone. This greenstone was doubtless poured out on the dry land, for it bears evidence of being eroded by rains and streams prior to the deposition of the overlying rocks.

Let us go down again, and examine the junction between these red rocks, with their intrusive dikes and overlying beds of greenstone, and the crystalline schists below.

We find these lower rocks to be composed chiefly of metamorphosed sandstones and shales which have been folded so many times, squeezed, and heated, that their original structure, as sandstones and shales, is greatly obscured, or entirely destroyed, so that they are called metamorphic crystalline schists.

Dame Nature kneaded this batch of dough very thoroughly. After these beds were deposited, after they were folded, and still after they were deeply eroded, they were fractured, and through the fissures came floods of molten granite, which now stands in dikes, or lies in beds, and the metamorphosed sandstones and shales, and the beds of granite, present evidences of erosion subsequent to the periods just mentioned, yet antecedent to the deposition of the non-conformable sandstones.

Here, then, we have evidences of another and more ancient period of erosion, or dry land. Three times has this great region been left high and dry by the ever shifting sea; three times have the rocks been fractured and faulted; three times have floods of lava been poured up through the crevices, and three times have the clouds gathered over the rocks, and carved out valleys with their storms. The first time was after the deposition of the schists; the second was after the deposition of the red sandstones; the third time is the present time. The plateaus and mountains of the first and second periods have been destroyed or buried; their eventful history is lost; the rivers that ran into the sea are dead, and their waters are now rolling as tides, or coursing in other channels. Were there cañons then? I think not. The conditions necessary to the formation of cañons are exceptional in the world's history.

We have looked back unnumbered centuries into the past, and seen the time when the schists in the depths of the Grand Cañon were first formed as sedimentary beds beneath the sea; we have seen this long period followed by another of dry land--so long that even hundreds, or perhaps thousands, of feet of beds were washed away by the rains; and, in turn, followed by another period of ocean triumph, so long, that at least ten thousand feet of sandstones were accumulated as sediments, when the sea yielded dominion to the powers of the air, and the region was again dry land. But aerial forces carried away the ten thousand feet of rocks, by a process slow yet unrelenting, until the sea again rolled over the land, and more than ten thousand feet of rocky beds were built over the bottom of the sea, and then again the restless sea retired, and the golden, purple, and black hosts of heaven made missiles of their own misty bodies--balls of hail, flakes of snow, and drops of rain--and when the storm of war came, the new rocks fled to the sea. Now we have cañon gorges and deeply eroded valleys, and still the hills are disappearing, the mountains themselves are wasting away, the plateaus are dissolving, and the geologist, in the light of the past history of the earth, makes prophecy of a time when this desolate land of Titanic rocks shall become a valley of many valleys, and yet again the sea will invade the land, and the coral animals build their reefs in the infinitesimal laboratories of life, and lowly beings shall weave nacre-lined shrouds for themselves, and the shrouds shall remain entombed in the bottom of the sea, when the people shall be changed, by the chemistry of life, into new forms; monsters of the deep shall live and die, and their bones be buried in the coral sands. Then other mountains and other hills shall be washed into the Colorado Sea, and coral reefs, and shales, and bones, and disintegrated mountains, shall be made into beds of rock, for a new land, where new rivers shall flow.

Thus ever the land and sea are changing; old lands are buried, new lands are born, and with advancing periods new complexities of rock are found; new complexities of life evolved.