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#### EPILOGUE - THE GRAND CANYON TODAY

Lake Powell commemorates Glen Canyon in much the same sense that a statue commemorates a famous man. But sculptured marble can no more give vicarious satisfaction to those who knew his charms than can the lake that fills Glen Canyon replace the beauties it has submerged in the memories of those who journeyed on the river that flowed a few short years ago between its walls.

A monument to a person is thus an inadequate reminder to his close friends; it speaks only to the public in historical terms. It celebrates his public life; his gentler private qualities and personal attachments are not communicated. And so with Glen Canyon, Lake Powell celebrates the short history of the construction of the dam that destroyed it; of the filling of the basin behind the dam with water of the Colorado River; of the development of commercial facilities on the shores of the lake; and of the ever-increasing crowds that come with high-speed motor boats and water skis to make use of these facilities. These are what Lake Powell memorializes. But the long unrecorded secret history of Glen Canyon, fragments of which survive fleetingly in the minds of the canyon's few explorers, lies drowned and lost.

To the motor boatist the lake presents superb opportunities for racing about in his high-powered craft. He can

speed for hundreds of miles from gasoline pump to gasoline pump with hardly more than a glance at the half-submerged tapestried sandstone walls. When boredom overtakes him he can break the monotony with water skiing, an activity that too soon palls. Always seeking new artificial thrills to lessen the drag of time, he roars into narrow, flooded tributary canyons, side-slipping around the tight S-curves at thirty miles an hour.

Not long ago one could walk in these side canyons beside reflecting pools upon a smoothed-out sandstone floor in an atmosphere aglow with filtered sun and sky. The boatman, to whom the undammed river could once have provided wondrous experiences, knows nothing of these lost glories, regrets them not, and belittles them in his ignorance. Nowhere in the world are these drowned canyons duplicated. In place of infinite variety, awesome convolutions, mysteries and secret recesses, glowing painted walls and golden streams, we have received in exchange a featureless sheet of water, a dead basin into which all the flotsam from the surrounding land accumulates with no place to go, a sink for sediments and the trash carelessly scattered about by throngs of visitors. The exchange is one of the greatest frauds ever perpetrated by responsible government on an unsuspecting people. They have been cheated out of a birthright without ever knowing they possessed it.

The fern-bedecked amphitheaters, where the only sounds heard were the plink of dripping water or the sudden cascading song of a canyon wren, the mirroring pools under a curving, banded cliff, and the sheets of silent sliding water are no more. The ends of the side canyons are now clogged with driftwood and the debris from suffocated and dying trees. The banks are everywhere undermined and are slipping into the lake leaving behind unstable sandy walls of exposed roots. Mud that formerly was flushed down into the big river by freshets and flash floods is deposited now in the shallows, covering the approaches to the upper reaches of the canyons with quaking layers of ooze and quicksand. In these backwaters loaded with decay and decomposition an explosion of algal growth is taking place, turning the water into a murky green soup and coating it with thick layers of scum. Scattered throughout the packed wreckage of vegetation are Coke and beer cans, plastic containers, film cartons, packaged food wrappings, and empty suntan lotion bottles, the discard of an irresponsible civilization.

A dead lake has replaced a living river, and even the dead lake is threatened with further deterioration from pollution. Where recently flowing water lapped at green banks; where willows, tamarisk, cottonwood, and oak groves crowded to the water's edge; where teaming riparian life filled all the niches in the ribboned oasis carved by the river into the Colorado Desert; where great blue herons waded and

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fished through the summer months; where beaver burrowed into the clay banks; where lizards darted among the rocks of the talus slopes; where deer came down from the dry highlands to drink and browse; and where in spring a dozen kinds of warblers sang or built their nests in the budding thickets, now barren rock are all that remain. Life is gone, drowned, dispersed, departed, extinguished for want of room and a place to breed. The plunging cliffs are licked by the wake of passing boats reflected from wall to wall. No songs of birds now are heard; in their stead we have the whine and roar of internal combustion engines.

This is the monument men have built -- you and I -- not to the lost Eden so few knew, but to their engineering ingenuity and ruthless ability to transform the land, to remake it simply for the sake of remaking it, thoughtlessly, improvidently. Gone is indeed an Eden, an Eden of multifarious, wondrous canyons, some deep, dark and narrow, some wide and long, some cut in bare rock and boulder-strewn, some green and sunlit. They all bore names suited to their particular attributes: Mystery, Twilight, Dungeon, Labyrinth, Cathedral, Hidden Passage. And one, because of difficulty access, was called Lost Eden -- a name which truly speaks for its own and the fate of all the rest.

A few miles below Glen Canyon Dam, at Lee's Ferry, the Grand Canyon of the Colorado begins. If the plans of the engineers were to prevail, long stretches of this incomparable

geological phenomenon would suffer the same fate as Glen Canyon. Fortunately, owing to the dedicated efforts of those who appreciate the aesthetic and scientific value of this famous gorge more than the commercial uses to which it could be put for the profit of an unenlightened few, these schemes have finally been forestalled.

Before the construction of Glen Canyon Dam, Lee's Ferry was the only available crossing of the Colorado River between Hite at the mouth of White Canyon more than one hundred miles to the north, and Hoover Dam over three hundred miles down stream. Nor where the Grand Canyon comes to an end as the river debouches from lower Granite Gorge at Grand Wash cliffs near the head of Lake Mead does a road crossing exist. At Lee's Ferry boat trips through Grand Canyon start. Here the river, flowing due south through Marble Gorge, at the beginning of its penetration of the Kaibab Plateau, has ground its way down through hundreds of feet of layered limestone. These hard gray metamorphosed rocks, polished by the fast-flowing, sediment-laden water give the gorge its name. Below its confluence at mile sixty-two with the Little Colorado, the river swings with seeming perversity in a long arc westward into the heart of the plateau.

The apparent paradox of a river flowing into and bisecting a mountain instead of being deflected from its course becomes understandable in terms of the tectonic forces involved with the extensive upwarping of the entire Colorado

Plateau. The Grand Canyon by geological measure is young, perhaps no older than a few million years. At the beginning of the canyon's history the Colorado River followed much the same route it takes today but it was a meandering stream flowing through low lands on its long journey to the Gulf of California. Initiated by changes in the plastic mantle of the earth deep below the crust, the whole area began to rise, but the rate of uplift was no faster than the river could keep step with by eroding its channel ever deeper. And as the land rose higher the river flowed more swiftly and carried a greater burden of sediments which were the tools for its labors. Probably the river was pushed somewhat away from its original course as is suggested by the route it occupies today, south of the highest point of the Kaibab Plateau; but it was not completely deflected and continued on in a generally westward direction. During the millions of years that this upheaval has continued the Colorado has gouged into layer after layer and formation below formation of sedimentary deposits. Down through the Tertiary and into the Cretaceous Period it has sliced, and on into still earlier periods. It cut past the great unconformities that had resulted from the sweeping away by ancient erosions of the deposits of scores of millions of years; and on it wore through the sediments of the Cambrian Period laid down before the advent of life on land. Below the layers of the Cambrian in those of the Proterozoic Era the record of the earth more

than half a billion years ago dims into uncertainty. The rocks dating from that time have been transformed by pressure and temperature and igneous intrusion into crystalline schists and granites. They are dark and hard, but the river has ground into them hundreds of feet. The end of the adjustment is not yet in sight; the river is still cutting and the uplift is still continuing.

Grand Canyon is as different from Glen Canyon as night is from day. Grand Canyon represents the climax of the river's grinding effort to maintain its course; and young as Grand Canyon is the river has been here longer at its enforced labor than in Glen Canyon. More cubic miles of rock have been pulverized to sand and washed away in the gorge that splits the Kaibab uplift than in most known river canyons, and the task was accomplished in shorter time than a similar task by any comparable major river. The erosion of Glen Canyon is a still more recent product of the Colorado River. Its creation has consumed scarcely a tenth the time that has elapsed in the formation of Grand Canyon.

Historians measure time in terms of human lives -- in generations and hundreds of years. Geologists, historians of the earth, think of events in cycles that span vastly greater periods -- thousands and millions of years. But even a million years is only one hundredth of one per cent of the known age of the earth. The Colorado River probably began its carving of Glen Canyon not more than one million

years ago, that is, in the Quarternary Period, the last two tenths of the Cenozoic Era -- the Age of Mammals -- when man's anthropoid ancestors were beginning their first tentative experiments with an erect posture and the crudest tools.

To appreciate the evanescence of topography under the working of erosive forces it is necessary to consider change in the perspective of geological time. The Colorado River and its tributaries have sliced into the Mesozoic sandstones of what is now southern Utah to a depth of about a thousand feet. Assuming that this process began a million years ago, the annual abrasion, if continued at a constant rate, would have been a little over one hundredth of an inch a year, an amount unnoticeable even when totalled over a human lifetime. At double this rate the cutting still would have been inappreciable, but we can guess that for a time at the beginning of this period, and intermittently since then, the river eroded its channel very much more rapidly. Had the channeling been a slow drawn-out affair, we would not find today the abrupt profiles of the tortuous, highly convoluted tributary canyons or the vertical cliffs bordering the main river. They would show the gradual slopes of more mature canyons. The precipitous walls would have been broken down and the narrow slots in the sandstone with overhanging sides would have been opened up and widened at the top. We know that the rate of erosion in very recent times, within the last few thousand years at most, has not been a continuous

steady process. It has fluctuated greatly, in conjunction probably with climatic changes. The evidence for this sequence of events is clear to read in the deposits of sand dozens of feet thick found in many of the side canyons. Not so long ago the rounded, bare rock bottoms of these tributaries were exposed. Thundering turbulent streams, the run-off from the land above of constant heavy rains, undercut the sides and hollowed out the bends. Water racing down the narrow channels to join the main river carried all before it in a grinding flood.

As the climate changed and the rains diminished, the floods in Glen Canyon became less frequent and less violent. Then the streams began to deposit their sediments, to build up layer on layer of mud and sand over the rock floors. The seeds of trees and grass and all manner of plants germinated in the deposits within protected alcoves. The vegetation grew and spread, covering the banks, and the streams became gentle brooks flowing meandering courses among the reeds and horsetails and willows. The period of fast erosion had come to an end with the development of a drier climate. The canyons had become spring-fed green oases in a desert land. However, nothing in nature -- nothing in life or land or climate -- long remains unchanged, change being the order of things. Within the recent past the tributaries to Glen Canyon began to reverse the process of sedimentation; deposits were cut down and washed out leaving isolated and dying groves

of trees high above the streams that formerly kept them alive. Steep eroded banks of sand developed out of which masses of exposed roots dangled. And the old curved rock floors of some of the narrowest canyons were again exposed. Perhaps a new period of fast cutting was on the way. If this were the case, the trend has been interrupted by the imposition of Glen Canyon Dam across the channel of flow. The dam is a temporary block to a course of events about which geologists have only just begun to speculate. But in the vastness of geological time we know that the episode of the dam is but the blink of an eye.

Grand Canyon reflects less dramatically the same climatic oscillations that accompanied the Pleistocene glaciations, which played such an important role in the shaping of Glen Canyon. With ten-fold more time consumed by the river in gouging out Grand Canyon, the results of the changing weather, where evident at all, are visible as secondary alterations of its towering sides and not in the adamantine rocks of the dark gorge where the Colorado River was flowing while Glen Canyon was still in its infancy. The different manifestations of the wet period are attributable both to the relative ages of the canyons and to the formations through which they have been eroded. Glen Canyon was cut into the softer Navajo and Wingate sandstones and shales of the Mesozoic Era. The later formations, which covered these enormously thick layers of Aeolian origin of the reptile age, have been completely swept

away over vast areas. Only scanty evidence of earlier canyons in the vanished Cenozoic strata exists today. The same denudation process, by which thousands of feet of sedimentary rock have been removed under the influence of the continued uplift, has progressed much farther over the Kaibab Plateau from which even the Mesozoic strata have largely disappeared. The formations now exposed, out of which the ancient river has hewn the multicolored buttes and temples and soaring cliffs of the present day Grand Canyon, belong to the Periods of the Paleozoic from the Permian to the Cambrian. Many unconformities are found between the strata of these periods that tell of great mountain ranges upthrust and totally washed away. What survived in great part are metamorphosed limestone produced from the calcareous remains of marine animals that sifted down through the waters of shallow seas for years beyond reckoning to build deposits of immense thickness. These limestones compose the walls of Marble Canyon and the Red Wall limestone cliffs high on the sides of Grand Canyon proper. They are stained by the iron containing washings from layers above of more complex composition, but where they plunge into the river in Marble Canyon or where angular talus fragments are exposed to the action of sediment-loaded running water the rock is highly polished. It is from these multifaceted, glistening surfaces that Marble Gorge derives its name.

Harder than Navajo sandstone though limestone is, and less readily abraded, it is more quickly eroded by solvent action. Water flowing into cracks and fractures, especially if weakly acid, dissolves the stone, enlarging the channel and creating in time aquifers of great extent and complexity. Limestone country is famous for its caverns and underground rivers produced in this way by solution of the rock. In Marble Canyon these channels have in places near the water's edge coalesced into a honeycomb of cavities. In Grand Canyon, aquifers in the Red Wall limestone feed springs on the canyon sides where the lime-laden waters on exposure to air redeposit the dissolved mineral in formations like those that surround hot springs or that occur as stalactites and stalagmites in caves. These accretions, which in time build up into huge mounds of reticulated porous stone called travertine, are found in many places on the lower walls of Grand Canyon. The great majority today are dried up and inactive, but a few of the springs, notably Travertine Grotto, Travertine Falls, and the warm springs below Lava Falls, still flow.

During periods of much greater precipitation in the Southwest, associated with the farthest advance of the continental ice sheet, when the tributaries of Glen Canyon were roaring torrents, the travertine springs of Grand Canyon were all active and overflowing. Then the canyon walls were greener than today. As with the few that still run, all then were surrounded with thickets of canes and willows, and the

terraced limey basins were bordered with wild celery and watercress. Hundreds of waterfalls poured from the cliffs of the inner gorge or shot down inclined chutes built of reprecipitated lime and plunged into space. From the evidence of the disintegrating and discolored travertine hanging on the precipices like candle drippings, one can easily imagine the beautiful and awesome spectacle that Grand Canyon presented in the late Pleistocene. Not only were the canyon walls alive with inflowing water and luxuriant vegetation, the river itself was many times greater than today. It filled its channel from wall to wall. It was an irresistible torrent of hundreds of thousands of cubic feet of water, thick with rock dust and debris, passing by each second, which could roll before it with ease house-sized boulders.

When one contemplates this recreated Colorado of scarcely 50,000 years ago, the river of Grand Canyon today even at its greatest flood seems tame indeed. But in our time it has been tamed still more by the building of Glen Canyon Dam. Its water carries no burden of silt from the mountains of Wyoming or Colorado, or from the deserts of Utah. The upper Colorado River, the Dirty Devil, the Escalante, the San Juan, and all the smaller creeks drop their sediments now in the still waters of Lake Powell. Below the dam, except when the Paria is in flood, the river runs clear and blue-green as far as its junction with the

Little Colorado. The rapids in Marble Gorge are foaming white. And on those infrequent occasions when the Little Colorado -- usually a thick brown soup -- runs milky blue like Havasu Creek, the main river may be siltless all the way to Lake Mead.

For nearly a century the Grand Canyon has been known from its rim. The magnificence of the view from the top-most sharp-edged cliff down into the terraced interior is world famous. The awesome ambiguity of scale fascinates or repels those who gaze into the canyon for the first time. The torn inverted landscape lying spread out below is a raw wound in the earth's skin in which the exposed anatomy has the colors of unhealed flesh. One looks down on buttes, the size of many an eastern mountain, that rise from plains thousands of feet below, though they appear to be almost within arm's reach. Distance to far cliffs and towers that fade into the indistinct purple haze are measureless. The river, glimpsed in places, seems to be directly below one's feet. So tiny it appears, no bigger than a mountain brook, that the first reaction is incredulity: Can this stream indeed have carved the whole vast landscape? But that it is the architect becomes more convincing as one descends into Granite Gorge and begins to hear its thunder.

But much less known is Grand Canyon from its river level. Millions have seen it from the top, whereas until the last few years hundreds only had journeyed through its

inner gorge. Recently these numbers have increased many-fold until today they have reached into the thousands, but still fall far short of the numbers of those who have merely looked down.

When Powell first explored the Colorado in 1869 it was an unknown river, considered unnavigable by most western explorers, and the Indians too warned that any attempt to float down it would end in certain death. No one knew how many or how great the cataracts were, or whether an impassable fall might be encountered at a place where no return was possible. No wonder then, after months of travel, half starved and exhausted, that Powell's men were depressed and discouraged by their first sight of the Granite Gorge. After the calm peace of Glen Canyon and to a lesser degree Marble, they could not view its black cliffs as less than portents of disaster. To them the gorge presented no relieving aspects; the narrowing walls were gloomy, oppressive, and foreboding. The adventure to them was worn thin. They could think of nothing but the end of the journey and escape.

Today, now that the river has been mapped and charted, a boat trip through Grand Canyon offers few of these frightening aspects. The rapids are all known, named, and measured, and the difficulties they present to navigation have been assessed. They all have been run by boats and rubber rafts; few are ever portaged or lined. Cataracts are encountered

by today's boatmen with less trepidation than may have affected Powell. But there is still plenty of excitement in the old river. Each rapid is a separate adventure, each has its special thrill. All share in common, however, the excitement provided by the swift glide down the smooth tongue where the river drops off at the head of the rapid and funnels with increasing speed into the first waves, and then by the crash of water over the boat. It is a thrill that never diminishes and which draws people back to the Grand Canyon time and again. New thrills too are being added which never would have been entertained when Nevils was leading his cataract boat trips thirty years ago. It has become a common sport to swim through some of the worst rapids in a life jacket. At one time this would have been considered suicide, but the sport has turned out to be quite safe. The swimmer bobs along over the standing waves with little sense of motion until he glances at the bank when he discovers to his surprise how fast he moves.

Regardless of modern innovations that have increased the safety of river running, one's life during a trip through Grand Canyon is dominated by the river. The river determines almost every detail of daily routine. Because its flow fluctuates on a diurnal rhythm, controlled by the release of water through the penstocks of Glen Canyon Dam, this domination is more true today than it was before the construction of the dam. The river decides where one camps, how far one

can travel in a day, at what time one can most easily navigate a rapid, and how it should be done.

Cataracts occur on the average of one every mile or two throughout the whole three hundred miles of Grand Canyon. They vary greatly in roughness and gradient, from a drop of a few feet spread over a quarter of a mile to more than fifteen feet in a hundred yards. Nevertheless, there are quiet stretches of water, of which Conquistador Aisle is one of the longest. In these one drifts along at a leisurely pace beside the black-veined walls of polished schist in sunless chasms, which having ceased to arouse a sense of foreboding provide welcome relief from the heat of the mid-summer sun. In the lower gorge walls of crumbling lava, that came tumbling into the canyon during an ancient period of volcanism, are masses of sliced off hexagonal columns, some of which are stacked vertically as though to buttress the cliff, others projecting end out, horizontally, like immense black honeycombs. No longer do these old lava flows carry the ominous implications they correctly bore for Powell, who in this part of the canyon came upon the two greatest rapids of the Colorado River, excepting the falls at Glenwood Springs -- Lava Falls and Lava Cliff -- the latter now submerged by the head waters of Lake Mead.

Never is the canyon traveler out of hearing of the sounds of the river. Its voice, heard from the smooth reaches between rapids, is muffled by distance, yet it forms part of the

background of sound that scarcely rises above the faint concoction of noises made by the murmuring wind and lapping ripples. But it is distinct from these, and swells, as one glides towards its source, into a characteristic soughing that obliterates all other noises until, as the foaming cataract comes into sight, it envelops all else in a thousand-fold rumble. It is the roar of a dozen freight trains crossing a trestle. The thunder of the river is its basic, authentic endowment. It accompanies one throughout the day and lulls one to sleep at night. But it can be ignored, pushed aside into some recess of consciousness and forgotten, until at the end of the trip as the boats float out onto still water, and the roar of the river fades back in space and time, all at once it is missed and one recognizes that the basic state of silence has returned. This is a regretful moment when one wishes he could be transferred back again into the turmoil and activity of the canyon.