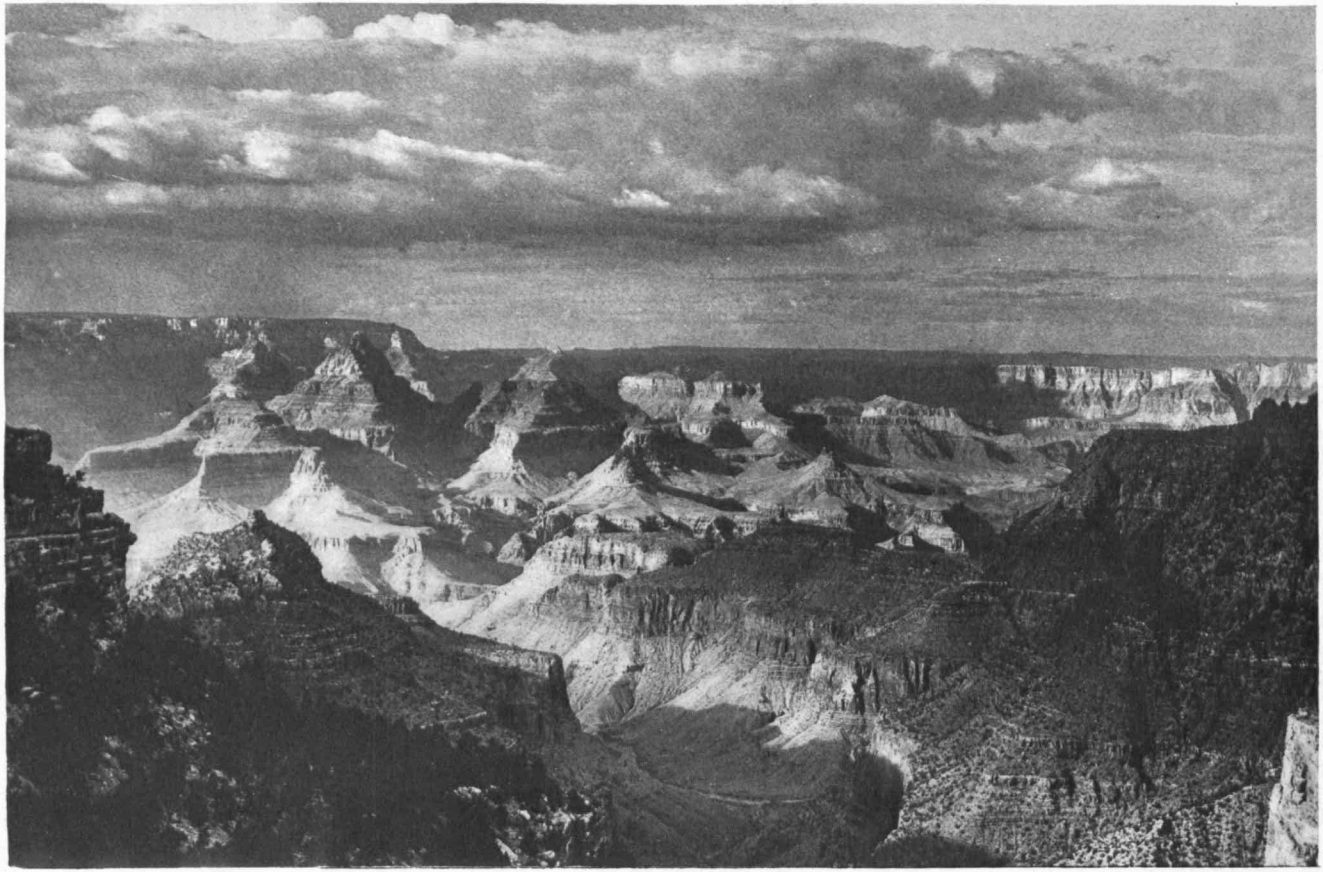


(*Photo by Putnam & Valentine*)

THE GRAND VIEW AT SUNSET

The Technology Review

Vol. VII. JANUARY, 1905 No. 1.

MAPPING THE GRAND CANYON.*

With the topographer on the United States Geological Survey, things are very much as with the army or navy officer. He seldom plans ahead more than six months. There is no telling where he will be after that time. The nature of his work demands his periodic return to headquarters at Washington, yet he never gets entirely settled there. He is ever ready to start off again at short notice, and proceed *via the shortest route* to some obscure, wondrously named place at the other end of the United States, there to resume the life nomadic. And, be it said, he dearly loves the same. Four months in the office are generally enough to make him sigh once more for a sniff of keen Western air, and to set him dreaming of breezy all-day rides over endless prairies, of desperate scrabbles above timber line, of scorching afternoons on a glaring desert. The infatuation is one few can shake off.

Having successfully wrestled with and conquered in turn three tall mountain ranges in the West, the writer next found himself commissioned with the survey of a hole in the ground. Not a mere depression of moderate extent, but a horrible, ragged rent, a chasm two hundred miles long, ten miles wide, and a full mile deep,—in fact, the Grand Canyon itself.

Perhaps there be some whose mental atlas is somewhat vague and non-committal regarding the location of this our greatest natural wonder. True, more than one State in the West boasts of a Grand Canyon, just as every other county in New England claims a Muddy Pond and a Beaver Brook. But *the* Grand Canyon, the glorious *forte-fortissimo* finale to the thousand-mile rhapsody of

*[Published by permission of the director of the United States Geological Survey.]

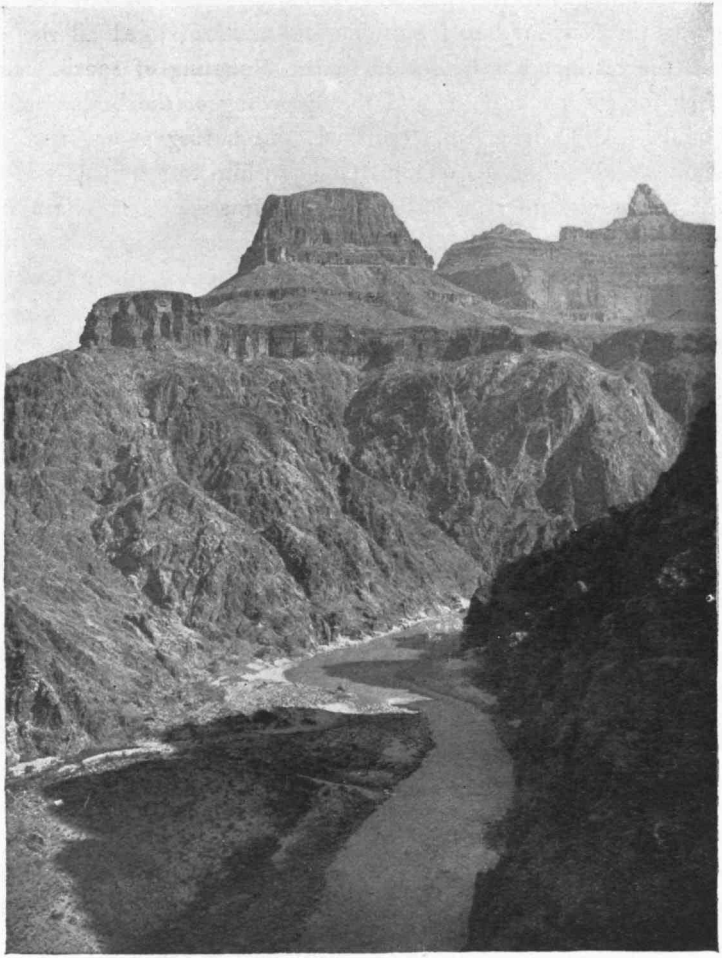
gorges and canyons of the Colorado River, is the only one your geography has no excuse to ignore. It is big enough to figure even on a Mercator's projection of the whole world.

Three years ago a spur line was built from the Santa Fé Railroad to the south rim of the Grand Canyon. Forthwith tourists poured in from every part of the world. Hotels arose like mushrooms, roads were cut through the dense forests of the plateau, trails were blasted down into the chasm. The demands for a modern and detailed map became urgent, from various quarters, for the most diverse purposes; and the Geological Survey thereupon detailed a party to commence work on the most important section of the Grand Canyon, that embracing its most superb scenery.

Late in March, 1902, "outfitting" was begun at Williams, Ariz., the starting-point of the Grand Canyon Railroad. Do not imagine there was a bustling scene of mustering with the thronging of many men. Modern mapping methods require no large field parties. Really, mapping is a two-men's job; and, had the topographer and his rodman the time to cook their meals, attend to the stock, and haul their provisions, there would be no need of further help. Often, indeed, the two do perform all these duties; for it is not always expedient to take the whole outfit along, up mountains or to other out-of-the-way places, where a few days will clean up the task. It is then that the adventures of a "side trip" may be tasted,—the sort of trip that is pre-eminently calculated to bring out in each man all his greatness or smallness.

Four individuals met at Williams; to wit, a topographer, a rodman, a professional camp cook, and a teamster, the latter in charge of a carload of camp equipage, wagons, and animals, all government property, and well worn in many a rough campaign. In a few hours, camp went up on the outskirts of the town, and the stars and stripes floated from the office tent. It was snowing hard, and kept at it for three days, accumulating a foot and a half, to the boundless joy of Arizona; but "outfitting" went on just the same.*

*The northern part of Arizona consists of high plateaus with a temperate climate. Williams has an elevation of 6,750 feet above sea-level. It lies thirty-two miles west of Flagstaff, where the Lowell Observatory is located.



The Colorado River in the Granite Gorge, here 1300 feet deep

The horses and mules were shod, and extra shoes fitted for them. The wagons were overhauled, and tires reset. In camp, men were busy mending harness, patching tents, painting stadia-rods, and rigging up pack saddles. The chief's activities ranged all the way from the testing of instruments to the designing of special mess-chests for the pack outfit and the recording of the brands of his animals. Also, being quartermaster, purchasing agent, and disbursing clerk all in one, it devolved upon him to spend part of his time discussing groceries with the groceryman and hardware with the hardware-man, and to devote his evenings to the consequent bills, vouchers, expense accounts, and other inevitable red tape.

When, finally, the party entrained for the Grand Canyon, it carried an "all-round" outfit, one that could be mobilized by wagon or by pack train over any kind of ground,—a camp that could be made comfortable in the hottest July or in zero weather, one that was adaptable both to the forest and to the desert and that could look respectable when set up at a tourist resort.

A dull gray snow-cloud hung over the landscape when we stepped out on the rim for a first peep at the great chasm. There it lay,—a scene of sullen, stony grimness, overwhelming by its vastness, baffling with its chaotic profusion of chiselled detail, but utterly devoid of charm. It did not capture our hearts, as the Rockies had done with their superb snow-flecked peaks, mirrored in romantic forest-fringed lakes. To the topographer's mind this was the superlative of all Arizona box-canyons, the biggest, deepest, and most dreaded of them all. It promised trouble,—heaps of it. But, then, one should not see the Grand Canyon at dawn with a snow sky. Even the Yosemite Valley looks dismal in that setting. Little did we anticipate how its sublime power was to grow upon us, until at the end of two years it seemed a hardship to leave it for the commonplace world of man.

Without a word we severally slunk back to our tent by the railroad track,—hastily pitched there by the light of a brakeman's lantern about midnight,—and set about liberating our poor horses from the stuffy box-car in which they had stood all night. Soon they were tied under the trees, contentedly munching in their nose-

bags. The cook tent was up and breakfast cooking, while sundry fragments of wagons, boxes, sacks, and barrels, and many bales of hay, were still issuing from the car. And the tourists stood about in gaping wonderment, watching these strange ruffians in khaki and corduroy, and the hustling cook in apron and leggings, and almost missed their train.

A cosy camp in the Coconino Forest

For several months the party worked along the south rim of the Grand Canyon, camping in various cosy nooks of the Coconino forest. Just two factors determined the selection of a camping place,—convenient proximity to the work and sufficient grass for the stock. Water there was none. It was hauled in barrels from the railroad, the only source of supply for the hotels and the rest of the population on the rim. And the railroad brought this water at great expense from points sixty, eighty, and frequently more than a hundred miles away.* Truly, Arizona is well named!

*The drinking water usually came from Del Rio, at the head of the Verde River, 120 miles from Grand Canyon Station.

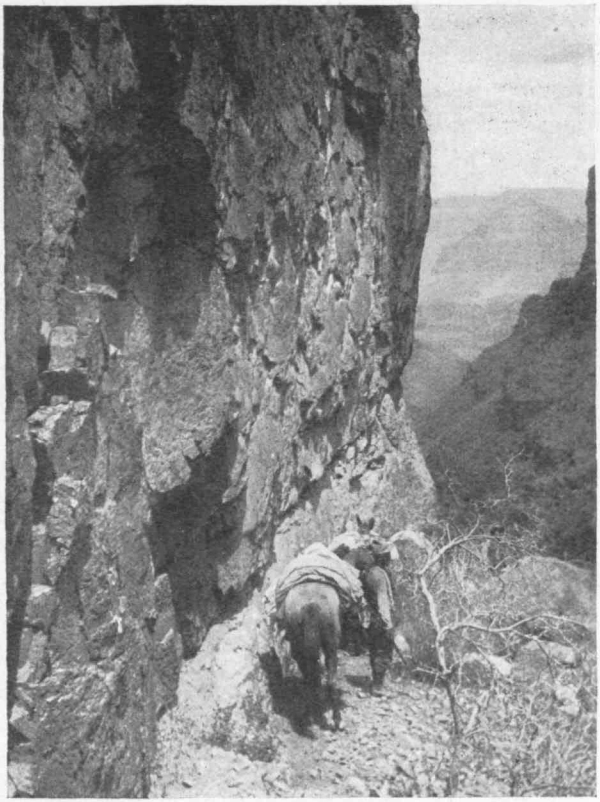
But the Colorado River? Well, it makes little difference whether there be water in the bottom of that mile-deep chasm or not. One might as well make a descent to the Styx for a cupful. Besides, its water is not worth journeying for, being scarcely potable and of a color and consistency much like cocoa.

For a space we helped ourselves to the snowdrifts, and the animals did the same; but after their disappearance—through evaporation mostly— the water team made daily trips. Further east we had the benefit of an artificial reservoir, or tank, as it is called in the West, dug years ago by enterprising stockmen. We stayed with it until it was reduced to a quivering mass of greenish slime. The traditional Arizona cloud-bursts, which were to replenish it, did not materialize that summer.

As for the grass, according to Eastern notions there was none; but, from the Arizona standpoint, it was thick among the trees of this peculiar open forest. The animals were turned out on it every night, hoppled, and did well. Only it required an expert at tracking to find them again in the morning, usually scattered and a mile or two from camp. They somehow developed a cunning habit of standing still when sought for, so that their stock bells hung silent without a tinkle. Sallying forth with the gray of dawn, the teamster generally managed to drive them in before breakfast.

About seven o'clock we would start out to work, mounted as a rule, with the plane-table, instruments, and tripod on a pack animal. A large sun umbrella, a pair of field-glasses, note-books, lunches, and a noon feed for the animals formed the rest of the pack. A heavy canvas sheet covered the whole, neatly tucked in all around, so that nothing could catch in the stiff, unyielding Arizona vegetation; and over all went a stout lash-rope twisted in that mysterious tangle known as the diamond hitch. An axe, two canteens with water, wetted on the outside, and a camera were carried on our saddles,—occasionally also a carbine. Usually from one to three stations were occupied during the day. The topography of the Grand Canyon proved to be next to ideal for plane-table methods, and the great bulk of the mapping was done by intersection work from well-chosen stations on the rim. Some of these commanded

such extensive panoramas that six and seven days were necessary to complete the work at any one of them. Thousands of intersections and hundreds of elevations from one instrument station,—there is no other place on earth where it can be done.



Under the Red Wall, on the Mystic Spring Trail

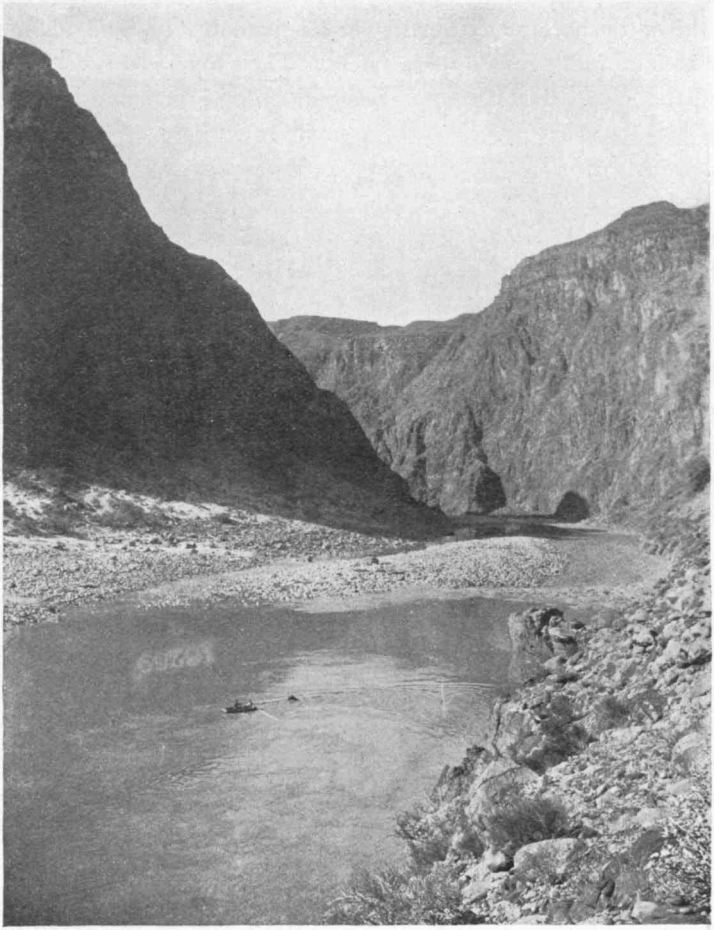
By midsummer the work along the south rim was finished, and we were ready to begin operations on the north side. The problem before us now was, How to get across? Few people have need to cross the dreaded Colorado River anywhere along its course, let alone through the Grand Canyon. From the bridge of the Denver & Rio Grande Railroad in Utah to "The Needles" on the

Santa Fé route there is a stretch of some seven hundred miles of river without a single bridge and with but two ferries. The nearest one of these, Lee's Ferry, the sole gateway between Arizona and Utah, is situated at the head of Marble Canyon. It meant to us a three-hundred-mile detour, for the most part through the Painted Desert. A nearer but even worse reputed route lay via the Mystic Spring Trail, across the very heart of the Grand Canyon, and some twenty-five miles west of our scene of work. It was nothing more than an ancient Pai-Ute pack trail, kept in an indifferent state of repair by a local prospector. A decrepit row-boat constituted the sole means of transportation across the river. This route we selected.

Speedily the wagon outfit was converted into a pack outfit. The number of pack-loads was carefully estimated, additional animals were hired, rations were figured down to a nicety. All articles that could be dispensed with were stored. No longer were we to indulge in the luxury of folding cots and camp-chairs, of a neatly covered dining-table, and a commodious wash-tub. Henceforth it meant a bed on the hard ground, and the top of a mess-chest for a table, picnic style. Candles were to be the sole illuminant, for kerosene is strictly taboo on a pack train. Three light tents were taken. Tent poles could be made when needed. Pack covers would do for tent floors, and no one was expected to encumber the expedition with voluminous bags of clothing.

Thus cut down to a minimum, the party began its descent into the pit. Every man walked. Every one of the ten pack and riding saddles carried a load. The trail, though steep and full of awkward turns, offered no serious obstacles; and by two o'clock we were busily engaged in lugging our paraphernalia on our own backs down the last hundred feet of ragged cliffs to the water's edge.

The boat, of course, lay on the wrong side of the river; and the two swimmers of the party had to plunge in and get it. The swim, far from refreshing in that tepid flood, left us as red as Indians. Incidentally, it was useful in establishing the most discouraging fact, that there was no shelving shore on the rocky south side, and that the landing of animals on our return would thereby be rendered



Swimming the animals across the river