4-1-1901

Fountains and Streams of Yosemite National Park.

John Muir

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low quarrels were getting to be too con
tempts on his teeth were chattering; the bruises on his face were swelling fast. He looked like a man that had been foully dealt with, — first well pounded and then ducked, as Hall had once seen an offender treated by angry fishwives in the port of Leith.

There was much heaviness among those Berwick men who stood bravely for Roger Wallingford; one of them, at least, refused to be comforted, and turned his face to the wall in sorrow when the lieutenant’s fate was discussed. At first he had boldly insisted that they would soon find out the truth; but there were those who were ready to confute every argument, even that of experience, and now even poor Cooper went sad and silent about his work, and fought the young squire’s enemies no more.

Sarah Orne Jewett.

(To be continued.)

THE FOUNTAINS AND STREAMS OF THE YOSEMITE NATIONAL PARK.

The joyful, songful streams of the Sierras are among the most famous and interesting in the world, and draw the admiring traveler on and on through their wonderful canions, year after year, unwearied. After long wanderings with them, tracing them to their fountains, learning their history and the forms they take in their wild works and ways throughout the different seasons of the year, we may then view them together in one magnificent show, spread out over all the range like embroidery, their silvery branches interlacing on a thousand mountains, singing their way home to the sea; the small rills, with hard roads to travel, dropping from ledge to ledge, pool to pool, like chains of sweet-toned bells, slipping gently over beds of pebbles and sand, resting in lakes, shining, spangling, shimmering, lapping the shores with whispering ripples, and shak-
The springs of the Yosemite Park, and the high Sierra in general, though many times more numerous, are comparatively small, oozing from moraines and snowbanks in thin, flat, irregular currents which remain on the surface or near it, the rocks of the south half of the range being mostly flawless impervious granite; and since granite is but slightly soluble, the streams are particularly pure. Nevertheless, though they are all clear, and in the upper and main central forest regions delightfully lively and cool, they vary somewhat in color and taste as well as temperature, on account of differences, however slight, in exposure, and in the rocks and vegetation with which they come in contact. Some are more exposed than others to winds and sunshine in their falls and thin plumelike springs; others are washed by streams receiving water from moraines and avalanche heaps on or near the axis of the range. It flows first in flat sheets over coarse sand or shingle derived from a granite ridge and the metamorphic slates of Red Mountain. The waters of many small branches, it runs through beds of moraine material, and a series of lakelets and meadows and frosty juicy bogs bordered with heathworvs and linked together by short boulder reaches. Below these, growing strong with tribute drawn from many a snowy fountain on either side, the glad stream goes rushing and swirling through clumps of the white-barked pine, and tanglew willow and alder thickets enriched by the fragrant herbaceous vegetation usually found about them. And just above the meadows of the lower level camp the river chafes and grinds to dust and turns many curves on its way round the edge of a little round sedgy meadow where nothing else grows; and when it is not shiny you can't see it, and you walk right into it as if there was nothing there. The first you know of that lake you are in it, and get tripped up by the water, and hear the splash. The waters of Illilouette Creek are nearly invisible in the autumn; so that, in following the channel, jumping from boulder to boulder after a shower, you will frequently drag your feet in the apparently surfaceless pools.

Excepting a few low warm slopes, fountain snow usually covers all the Yosemite Park from November or December to May or June. In it, or July, while on the coolest parts of the north slopes of the mountains, at a height of eleven to thirteen thousand feet, it is perpetual. It seldom lies at a greater depth than two or three feet on the lower margins, ten feet over the middle forested region, or fifteen to twenty feet in the shadowy canyons and cirques among the peaks of the summit, except where it is drifted, or piled in avalanche heaps at the foot of long converging slopes to form perennial fountains.

The first crop of snow crystals that whitens the mountains and refreshes the streams usually falls in September or October, in the midst of charming Indian-summer weather, often while the goldenrods and gentians are in their prime; but these Indian-summer snows, like some of the late ones that bury the June gardens, vanish in a day or two, and garden work goes on with accelerated speed. The grand winter storms that load the mountains with enduring fountain snow seldom set in before the end of November. The fertile clouds, descending, glide about and hover in brooding silence, as if thoughtfully examining the forests and streams with reference to the work before them; then small flakes or single crystals appear, glinting and swirling in zigzags and spirals; and soon the thronging featherly masses fill the sky and make darkness like night, hurrying wandering mountaineers to their winter quarters. The first fall is usually about two to four feet deep. Then, with intervals of bright weather, not very cold, storm succeeds storm, heaping snow on snow, until from thirty to fifty or sixty feet has fallen; but on account of heavy settling and compacting, and the waste from evaporation and melting, the depth in the middle region, as stated above, rarely exceeds ten feet. Evaporation never wholly ceases, even in the coldest weather, and the sunshine between storms melts the surface more or less. Waste from melting also goes on at the bottom from summer heat in the sun, as is shown by the rise of the streams after the first general storm, and their steady sustained flow all winter.

In the deep sugar-pine and silver-fir woods, up to a height of eight thousand feet, most of the snow lies where it falls, in one smooth universal fountain, until set free in the streams. But in the lighter forests of the two-leaved pine, and on the bleak slopes above the timber line, there is much wild drifting during storms accompanied by high winds, and for a day or two after they have fallen, when the temperature is low, and the snow dry and dusty. Then the trees, bending in the darkening blast, roar like feeding lions; the frozen lakes are buried; so also are the streams, which now flow in dark tunnels, as if another glacial period had come. On high ridges, where the winds have a free sweep, magnificent overcrowning cornices are formed, which, with the avalanche piles, last as fountains almost all summer; and when an exceptionally high wind is blowing from the north, the snow, rolled, drifted, and ground to dust, is driven up the converging northern slopes of the peaks, and sent flying for...
Fountains and Streams of Yosemite National Park.

trees, however, are usually followed by a deep peculiar silence, especially profound and solemn in the forests, and the noble trees stand motionless, as if under a spell, until the morning sunbeams begin to sift through their laden spires. Then the snow, shifting and falling from the top branches, strikes the lower ones in succession, and dislodges heavy masses all the way down. Thus each tree is enveloped in a hollow conical avalanche of fairy fineness, silvery white, irised on the outside; while the relieved branches spring up and wave with startling effect in the general stillness, as if moving of their own volition. These beautiful tree avalanches, hundreds of which may be seen falling at once on fine mornings after storms, pile their snow in raised rings around corresponding hollows beneath the trees, making the forest mantle somewhat irregular, but without greatly influencing its duration and the flow of the streams.

The large storm avalanches are most abundant on the summit peaks of the range. They descend the broad steep slopes, as well as narrow gorges and couloirs, with grand roaring and booming, and glide in graceful curves out on the mountains. Every fountain and stream of the upper rivers, even in the warmest June weather, they seem to cause outbounding or free plunging. Fortunately, though the grade of the cañon was steep, it was not interrupted by step levels or precipices big enough to cause outbounding or free plunging. On no part of the rush was I buried. I was only moderately imbedded on the surface or a little below it, and covered with a hissing back-streaming veil of dusty snow particles; and as the whole mass beneath or about me joined in the flight I felt no friction, though tossed here and there, and lurched from side to side. And when the torrent swelled and came to rest I found myself on the top of the crumpled pile, without a single bruise or scar. Hawthorne says that steam has spiritualized travel, notwithstanding the smoke, friction smells, and clatter of boat and rail riding. This flight in a milky way of snow flowers was the most spiritual of all my travels; and, after many years, the mere thought of it is still an exhilaration.

In the spring, after all the avalanches are down and the snow is melting fast, it is glorious to watch them sing out on the mountains. Every fountain swelling, countless rills hurry together to the rivers at the call of the sun; beginning to run and sing soon after sunrise, increasing until toward sundown, then gradually falling through the cold frosty hours of the night. Thus the volume of the upper rivers, even in flood time, is nearly doubled during the day, rising and falling as regularly as the tides of the sea. At the height of flood, in the warmest June weather, they seem fairly to shout for joy, and clash their undulating voices together like an eloquent band of words; racing down the cañons with white manes flying in glowing exuberance of strength, compelling huge sleeping boulders to wake up and join in the dance and song to swell their chorus.

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Then the plants also are in flood; the hidden sap singing into leaf and flower, responding as faithfully to the call of the sun as the streams from the snow, gathering along the outspread roots like rills in their channels on the mountains, rushing up the stems of herb and tree, swirling in their myriad cells like streams in potholes, spreading along the branches and breaking into foamy bloom, while fragrance, like a finer music, rises and breaks into foamy bloom, while in potholes, spreading along the branches and flowing with the winds.

About the same may be said of the spring gladness of blood when the red of the swelling plants and rivers, inclining to a thousand hues, ranging melody in color and fragrance, through all the quickening senses. The day, the variation so marked in spring being now too slight to be noticed. All the smaller tributaries, whose branches do not reach back to the highest trickling affluent of the Merced; while the main drainage, the main drainage, flowing northward, gives rise to those of the Tuolumne. After diverging for a distance of ten or twelve miles these twin rivers flow in a general westerly direction, descending rapidly for the first thirty miles, and rushing in glorious apron cascades and falls from one Yosemite valley to another. Below the Yosemites they descend in gray rapids and swirling, swaying reaches, through the chapparal-clad canyons of the foothills and across the golden California plain, to their confluence with the San Joaquin, where, after all their long wanderings, they are only about ten miles apart.

The main canyons are from fifty to seventy miles long, and from two to four thousand feet deep, carved in the solid flank of the range. Though rough in some places and hard to travel, they are the most delightful of roads, leading through the grandest scenery, full of life and motion, and offering most telling lessons in earth sculpture. The walls, far from being unbroken, featureless cliffs, seem like ranges of separate mountains, so deep and varied is their sculpture; rising in lordly domes, towers, round-bridged outstanding headlands, and clustering spires, with dark shadowy side canyons between. But, however wonderful in height and mass and fineness of finish, no anomalous curiosities are presented, no “freaks of nature.” All stand related in delicate rhythm, a grand glacial rock song. Among the most interesting and influential of the secondary features of cany scenery are the great avalanche taluses, that lean against the walls at intervals of a mile or two. In the middle Yosemite region they are usually from three to five hundred feet high, and are made up of huge angular well-preserved unshifting boulders, overgrown with gray lichens, trees, shrubs, and delicate flowering plants. Some of the largest of the boulders are forty or fifty feet cube, weighing from five to ten thousand tons; and where the cleavage joints of the granite are exceptionally wide apart a few blocks may be found nearly a hundred feet in diameter. These wonderful boulder piles are distributed throughout all the canyons of the range, completely choking them in some of the narrower portions, and no mountaineer will be likely to forget the savage roughness of the roads they make. Even the swift rushing rivers, accustomed to sweep everything out of their way, are in some places bridled and held in check by them. Foaming, roaring, in glorious majesty of flood, rushing off long rumbling trains of ponderous blocks without apparent effort, they are not able to move the largest, which, withstanding all assaults for centuries, are left at rest in the channels, like islands, with gardens on their tops, fringed with foam below, with flowers above.

On some points concerning the origin of these taluses I was long in doubt. From the beds above the cliffs below the canyons came they derived from, the cliffs above them, the size of each talus being approximately measured by a scar on the wall, the rough angular surface of which contrasts with the rounded, glaciated, unfractured parts. I saw also that, instead of being slowly accumulated material, weathered off boulder by boulder in the ordinary way, almost every talus had been formed suddenly, in a single avalanche, and had not been increased in size during the last three or four centuries; for trees three or four hundred years old were growing on them, some standing at the top close to the wall, without a bruise or broken branch, showing that scarcely a single boulder had fallen among them since they were planted. Furthermore, all the taluses throughout the range seemed, by the trees and lichens growing on them, to be of the same age. All the phenomena pointed straight to a grand ancient earthquake. But I left the question open for years, and went on from cany to cany, observing again and again; measuring the heights of taluses throughout the range on both flanks, and the variations in the angles of their surface slopes; studying the way their boulders were assorted and related and brought to rest, and the cleavage joints of the cliffs from whence they were derived, cautious about making up my mind. Only after I had seen one made did all doubt as to their formation vanish.

In Yosemite Valley, one morning about two o'clock, I was aroused by an earthquake; and though I had never before enjoyed a storm of this sort, the strange wild thrilling motion and rumbling could not be mistaken, and I ran out of my cabin, near the Sentinel Rock, both glad and frightened, shouting, “A noble earthquake!” feeling sure I was going to learn something. The shocks were so violent and varied, and succeeded one another so closely, one had to balance in walking as if on the deck of a ship among waves, and it seemed impossible the high cliffs should escape. In particular, I feared that the sheer-fronted Sentinel Rock, which rises to a height...
of three thousand feet, would be shaken down, and I took shelter back of a big pine, hoping I might be protected from outbounding boulders, should any come so far. I was now convinced that an earthquake had been the maker of the talus, and positive proof soon came. It was a calm moonlight night, and no sound was heard for the first minute or two save a low muffled underground rumbling and a slight rustling of the agitated trees, as if, in wrestling with the mountains, Nature were holding her breath. Then, suddenly, out of the strange silence and strange motion there came a tremendous roar. The Eagle Rock, a short distance up the valley, had given way, and I saw it falling in thousands of the great boulders I had been studying so long, pouring to the valley floor in a free curve luminous for a fifteen hundred feet span, as true in form and beautiful spectacle,—an arc of fire fifteen hundred feet span, as true in form and beautiful spectacle,—an arc of fire

cloud of dust particles, the smallest of the boulders, floated out across the whole breadth of the valley and formed a ceiling that lasted until after sunrise; and the air was loaded with the odor of crushed Douglas spruces, from a grove that had been mowed down and mashed like weeds.

Sauntering about to see what other changes had been made, I found the Indians in the middle of the valley, terribly frightened, of course, fearing the angry spirits of the rocks were trying to kill them. The few whites wintering in the valley were assembled in front of the old Hutchings Hotel, comparing notes and meditating flight to steadier ground, seemingly as sorely frightened as the Indians. It is always interesting to see people in dead earnest, from whatever cause, and earthquakes make everybody earnest. Shortly after sunrise, a low, dull muffled rumbling, like distant thunder, was followed by another series of shocks, which, though not nearly so severe as the first, made the cliffs and domes tremble like jelly, and the big pines and oaks thrill and sway and wave their branches with startling effect. Then the groups of talkers were suddenly hushed, and the solemnity on their faces was sublime. One in particular of these winter neighbors, a rather thoughtful, speculative man, with whom I had often conversed, was a firm believer in the cataclysmic origin of the valley, and I now jokingly remarked that his wild tumble-down-and-engulfment hypothesis might soon be proved, since these underground rumblings and shakings might be the forerunners of another Yosemite-making cataclysm, which would perhaps double the depth of the valley by swallowing the floor, leaving the ends of the wagon roads and trails three or four thousand feet in the air. Just then came the second series of shocks, and it was fine to see how awfully silent and solemn he became. His belief in the existence of a mysterious abyss, into which the suspended floor of the valley and all the domes and battlements of the walls might at any moment go roaring down, mightily troubled him. To cheer and tease him into another view of the case, I said: "Come, cheer up; smile a little and clap your hands, now that kind Mother Earth is trotting us on her knees to amuse us and make us a good." But the well-meaning joke seemed irreverent and utterly failed, as if only prayerful terror could rightly belong to the wild beauty-making business. Even after all the heavier shocks were over, I could do nothing to reassure him. On the contrary, he handed me the keys of his little store, and, with a companion of like mind, fled to the lowlands. In about a month he returned; but a sharp shock occurred that very day, which sent him flying again.

The rocks trembled more or less every day for about two months, and I kept a bucket of water on my table, to learn what I could of the movements. The blunt thunder tones in the depths of the mountains were usually followed by sudden jarring horizontal thrusts from the northward, often succeeded by twisting, upjolting movements. Judging by its effects, this Yosemite, or Inyo earthquake, as it is sometimes called, was gentle as compared with the one that gave rise to the grand talus system of the range and did so much for the eaeon scenery. Nature, usually so deliberate in her operations, then created, as we have seen, a new set of features, simply by giving the mountains a shake,—changing not only the high peaks and cliffs, but the streams. As soon as these rock avalanches fell every stream began to sing new songs; for in many places thousands of boulders were hurled into their channels, roughening and half damming them, compelling the waters to surge and roar in rapids where before they were gliding smoothly. Some of the streams were completely dammed, drifted, woods, leaves, etc., filling the interstices between the boulders, thus giving rise to lakes and level reaches; and these, again, after being gradually filled in, to smooth meadows, through which the streams now silently meander; while at the same time some of the taluses took the places of old meadows and groves. Thus rough places were made smooth, and smooth places rough. But on the whole, by what at first sight seemed pure confusion and ruin, the landscapes were enriched; for gradually every talus, however big the boulders composing it, was covered with groves and gardens, and made a finely proportioned and ornamental base for the sheer cliffs. In this beauty work, every boulder is prepared and measured and put in its place more thoughtfully than are the stones of temples. If for a moment you are inclined to regard these taluses as mere draggled, chaotic dumps, climb to the top of one of them, tie your mountain shoes firmly over the instep, and with braced nerves run down without any haggling, putting hesitation, boldly jumping from boulder to boulder with even speed. You will then find your feet playing a tune, and quickly discover the music and poetry of rock piles,—a fine lesson; and all nature's wildness tells the same story. Storms of every sort, torrents, earthquakes, cataclysms, "convulsions of nature," etc., however mysterious and lawless at first sight they may seem, are only harmonious notes in the song of creation, varied expressions of God's love.

John Muir.