YOSEMITE NATURE NOTES

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Echo Peaks, Yosemite National Park
—Ralph Anderson

Clarence Stro

Aerial view of Yosemite Valley and the Yosemite high Sierra. The thinking that lay behin the various interpretations of the origin of this valley, as reviewed in "Early Theories o Yosemite's Formation," may better be appraised through reference to the above compre hensive scene.

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EARLY THEORIES OF YOSEMITE'S FORMATION

By Richard J. Hartesveldt, Ranger Naturalist

Before the excellent geological studies of Yosemite Valley were made by Francois Matthes, several conflicting theories were advanced by scientists and laymen concerning the origin of the famed chasm. After reading Matthes' clear-cut, widely accepted geologic history of the valley, one finds difficulty understanding why so many erroneous hypotheses were formulated. Yet, the field of geology was young at the time of the Yosemite discovery and the age of believing is catastrophic formation of earth features was not quite dead, so perhaps it is natural that a few such theories should have been proposed. Even some of the more highly trained geologists of former days were responsible for suggesting spectacular, violent origins. And without a doubt the geological evidence that seems obvious today may not have been as easily understood then.

It is not known to whom credit should go for the first attempt at explanation, but it seems probable that members of the Mariposa Battalion hazarded a few crude guesses about the formation of Tenaya's great mountain fortress on the day it was discovered in March 1851. Dr. Lafayette Bunnell, surgeon for the historic expedition, was the person most likely to be given to such thoughts; however, no mention is made of them in his book *Discovery of the Yosemite*. Published in 1880, this valuable report does carry a discussion of the later controversy between John Muir and the geologist Josiah D. Whitney over the mode of the valley's evolution.

Because of his position as California state geologist, Whitney's mistaken concept did much to influence the thinking of others. His published account of the valley's origin in 1865, in *Geological Survey of California: Geology, Vol. I*, is the earliest known, and came forth after he had led an expedition through the Sierra Nevada 2 years before. Lack of the typical U-shaped cross section and the small amount of talus in the main part of Yosemite Valley led Whitney's reasoning away from a consideration of erosion and may have been the main factors which caused him to discredit the glacial hypothesis. He conceived this region to be heavily fractured and that during the upheaval of the range many huge blocks of rock dropped downward into the earth's crust, leaving the elongated void without talus. This he claimed

Tenaya Canyon from Glacier Point, Half Dome on right

was particularly evident at Half Dome, and at El Capitan and Cathedral Rocks where he noted the common occurrence of tall cliffs facing downcanyon at right angles to the axis of the valley. It seemed totally illogical to him that normal erosive agents such as flowing water and ice could have been responsible for features of this nature. He supposed the massive domes to have been created in the initial mountain upheaval; again, erosive factors "were not apparent." His flare for the disastrous is climaxed with his statement concerning Half Dome, which "seems, beyond a doubt, to have been split asunder in the middle, the lost half having gone down in what may truly be said to have been 'the wreck of matter and the crush of worlds.'"

Some confusion exists as to just what Whitney did believe regarding ice as an agent of canyon sculpture here. In his earliest account he took note of the Bridalveil moraine and a few other manifestations of glaciation that were brought to his attention by Clarence King, one of his assistants. He commented on the damming of the valley by this moraine and the impounding of a lake which later filled in with glacially ground rock — probably from the high-country glaciers which he assumed to have stopped at the valley rim. He also recognized that the morainal ridge marked a change in the amount of talus—much downstream, little upstream. Having recorded King's glacial evidence in one writing, Whitney seems to have forgotten or discounted it, for in *The Yosemite Guide-book* published in 1870, he strongly denounces a glacial concept: "A more absurd theory was never advanced . . ." He could perceive nothing here as was found in the Alps, no proof that glaciers ever existed in Yosemite Valley. The bitter nature of his writings undoubtedly reflected his feelings toward the ice doctrine and those who subscribed to it. Said Whitney, ". . . this theory, based on

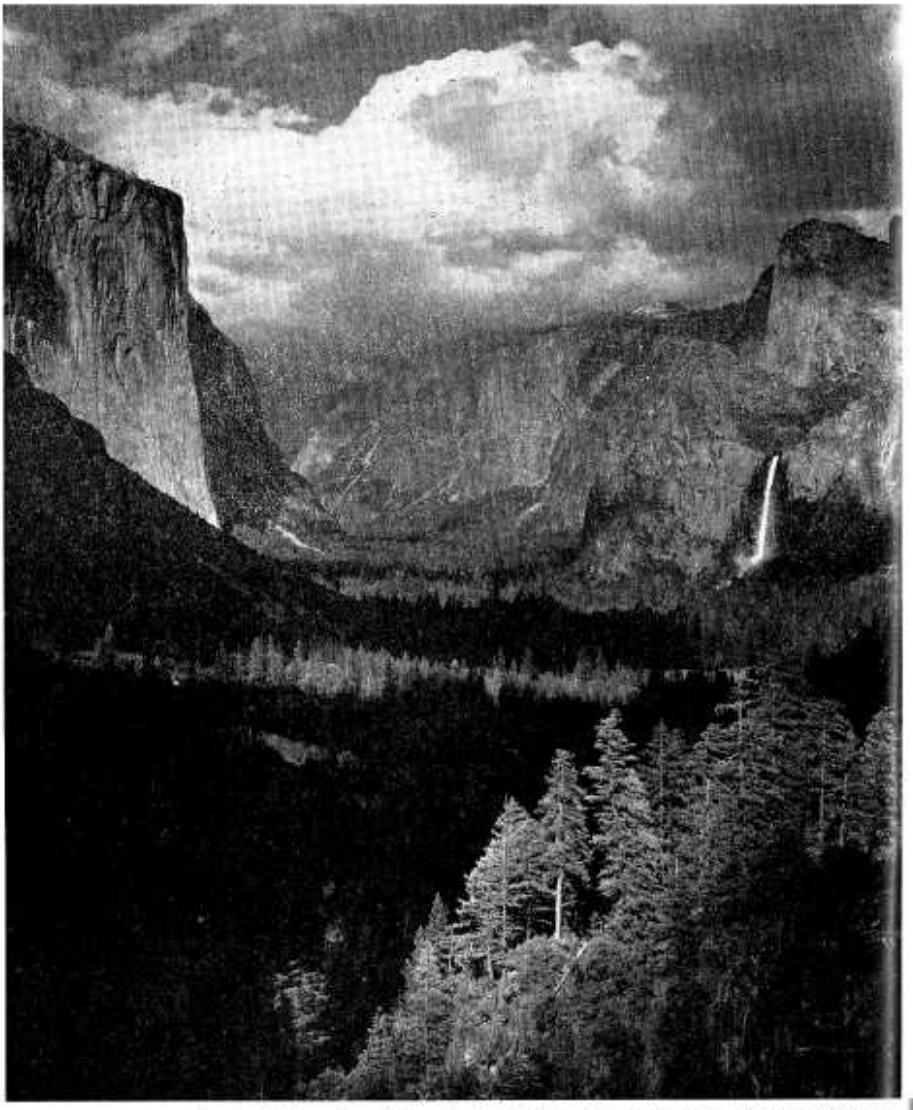
entire ignorance of the whole subject, may be dropped without wasting any more time upon it." He clung tenaciously to his sunken-block proposition. The lack of debris along the valley walls was, he explained, due to the fact that it had all fallen into the great abyss and was covered with later sediments.

Clarence King's version was no less spectacular than Whitney's. In his volume *Mountaineering in the Sierra Nevada* King states, "In this cold, naked strength, one has crowded on him the geological record of mountain work, of granite plateau suddenly rent asunder . . ." A split in the range half a mile wide! King was alone in his opinion. His superior, Josiah Whitney, rebelled at the idea mainly because the irregularities of the opposing walls of the valley did not correspond with one another. He thought, too, that the whole of the Sierra Nevada would have to have been separated into two parts and these moved bodily apart by half a mile. Even for the powerful Mother Nature this seemed too much to ask. King is credited as being the first man to discover the unmistakable evidences of glaciation in Yosemite Valley. However, his examination of the valley was not extensive enough and he envisioned a glacier only a thousand feet thick in it and of little consequence.

As early as 1866 a Prof. William Blake of the University of Arizona was the first to suggest an orderly, unspectacular formation of the valley by erosional processes—the work of both stream and glacier. The action of glaciers must have been poorly understood at the time because it was Blake's belief that tremendous torrents of water flowing beneath the ice were responsible for remodeling the original stream-carved canyon to its present configuration. At any rate his analyses were made known only to other scientists, unfortunately, so that the general public was not acquainted with his views.

The famed naturalist and mountaineeer, John Muir, was one of the first to comprehend a glacier's powerful method of erosion. During his lengthy stay in Yosemite he hiked far and wide among his beloved peaks, searching for indications of glaciation in one of the most meticulous studies ever made prior to the time of Francois Matthes. Muir's thoroughness may have irked Whitney into stubbornness against embracing the glacial interpretation. It is possible that Whitney resented the self-trained naturalist's expounding on geological matters that were not totally acceptable to a college-trained geologist. The two men argued at length over their theories.

Not enough can be said to the benefit of John Muir. Through his beautiful writings people gained a great appreciation of Yosemite, and through them and his own personal campaign the Congress was persuaded to establish Yosemite National Park by the act of 1890. Some of his geological observations, however, were quite as inaccurate as Whitney's. In an unqualified statement in his book *The Yosemite* Muir claimed that all of California was glaciated, that no part was left unaltered by the immense ice sheet. To him, ice was the sole agent of canyon, valley, and lake-basin sculpture. He postulated that considerably more than one mile of thickness of rock, on the average, had been stripped by glaciers from the top of the Sierra Nevada. His descriptions of glacial pavements, moraines, and erratics did much to increase the popularity of the glacial concept. Prof. Joseph LeConte



By Ansel Adams from "Yosemite and the Sierra Nevada," courtesy Houghton Mifflin Co.

Yosemite Valley. It was the high, angular cliffs of such formations as El Capitan, left, and Cathedral Rocks, right, some of whose planes face downcanyon, that Geologist Josiah Whitney claimed as proof of his dropped-block theory. He could not reconcile these features as the erosive work of water and ice.

of the University of California felt prone to agree with Muir in 1871 that glaciers had played an important role here, but as a proficient geologist he differed from Muir in laying much of the cutting to stream action before the ice age occurred.

In 1872 a professor of zoology from Massachusetts Institute of Technology, Samuel Kneeland, in his narrative *The Wonders of the Yosemite Valley, and of California*, wandered far from his academic field and wrote at some length about the geology of this area. He was in agreement with Whitney about the manner of formation of the original chasm, and he too saw no way in which water could produce the right angled cliffs at El Capitan and Cathedral Rocks. His inference about glaciers was not only that the ice had filled the valley but that the surface was at least a thousand feet higher than the valley rim. He conceived of little movement of the ice at the lower elevations, namely that which was confined within the

canyon walls, and did not credit this "insignificant portion" with having sculpturing powers. It was the glacial layer above the rim that was active. The more stationary part of the ice within the canyon remained much longer than the other and melted into a lake. At this point he rather abruptly concluded his composite theory.

As mentioned earlier, Dr. Lafayette Bunnell, one of the discoverers of Yosemite Valley, made a few geological observances in his book about this historic event. He concurred in part with both Muir and Whitney. The initial valley, he decided, was as Whitney had suggested. But Whitney's notion that the ice had halted before it entered the valley seemed absurd. Muir's exacting studies on glacial behavior left no room for controversy as far as Bunnell was concerned. He thought that the rounded boulders which he observed in the Merced River came from above the valley and that water could not possibly have moved them across the "sunken bed of the valley." In his opinion, the upper portion of the ice moved faster than the lower, thus carrying more material from the higher mountain peaks. He was somewhat uncertain about how much of the shaping of Yosemite Valley was performed by ice and thought it would never positively be determined.

Prof. Israel C. Russell of the University of Michigan, working in the Sierra Nevada in 1889, discovered conspicuous moraines at the mouths of canyons on the eastern side of the range. The much smaller moraine in the lower part of Yosemite Valley was proof enough for him that the glacier that had flowed through it was of small size, and that it was ineffectual as an eroding agent. Whitney's ability as a geologist induced Russell also to ad the dropped-block theory of orig

Galen Clark, the first guardian Yosemite during its earlier years a California state park, had am time while living here to make mc geological reflections, yet his in pretation is most unusual and parently is not based on any act field observation. Clark conceiv of great quantities of some kind gas, possibly steam, rising throu the semiplastic crust of the ea to bubble up on the surface as great domes. Should a bubble bu a large crater would be made. theorized that if several of the bubbles formed in a line, and tl if all of them burst, the result wou be a great chasm, the original semite chasm. The concept of su sequent glacial alteration he read accepted.

A member of the U. S. Geologic Survey, Henry Turner, in 1899 pos lated that Yosemite Valley w largely the product of stream e sion which was facilitated by t highly jointed structure of the gra ite; later the weathered rock deb was carried off by flowing ice whi he thought accomplished little el He believed that the farthest lir reached by the Yosemite glaci was in the vicinity of El Portal alor the Merced River. Turner w among the first persons to attribu the great acceleration of the Merc River and its consequent canyo cutting to an uplift of the Sierra N vada in preglacial time.

Brief opinions, many of them re etitious, were expressed by sever other people in the field of geolog To Henry Gannett, chief geogr pher for the U. S. Geological Surve the role of ice was paramount; th depth of glaciation was indicated b the elevation of the "hanging" sic valleys from whose mouths th waterfalls plunge into the canyo

Prof. John C. Branner of Stanford Junior University thought that ice was of small importance in Yosemite Valley. And E. C. Andrews, of the Department of Mines, New South Wales, saw the valley created by a gigantic cascade of ice that carved the gorge headward as it flowed, just as the Niagara Gorge has been created by the slowly receding Niagara Falls.

The lack of agreement among the various theorists continued into the early part of the 20th century. Meanwhile, Yosemite as a national park was attracting people from all parts of the world. In 1913 the members of the Sierra Club voiced a growing popular feeling that a valley of the magnitude and beauty of Yosemite deserved to be properly understood, and they requested that a competent study be made of the area by the U. S. Geological Survey, whose response was immediate. Dr. Francois E. Matthes, the geologist, and Mr. Frank C. Calkins, a petrologist, were the two men most responsible for the formulation of the complete story now told of Yosemite Valley's formation. Written as a professional treatise but with the appeal for the layman, Matthes' famed paper* *Geologic History of the Yosemite Valley* describes in detail every known aspect of the story from before the rise of the Sierra Nevada, through the cutting of the Merced Gorge by water and then ice, to the filling in of Ancient Lake Yosemite. Its fascinating contents leave no doubt in the reader's mind concerning the mode of origin of the Valley Incomparable.

*Available from Yosemite Natural History Association, $5.50 by mail.

YOSEMITE'S "CENTURY AVALANCHES"

By Fran Hubbard[1]

Few avalanches are more spectacular, particularly in their results, than the so-called "century avalanches," which at intervals thunder down the slopes of California's Sierra Nevada range. Writing of them, John Muir, who named them, said[2]:

> The great century avalanches . . . occur on mountain-sides about ten or twelve thousand feet high, where under ordinary weather conditions the snow accumulated from winter to winter lies at rest for many years, allowing trees, fifty to a hundred feet high, to grow undisturbed on the slopes beneath them. On their way down through the woods they seldom fail to make a perfectly clean sweep, stripping off the soil as well as the trees, clearing paths two or three hundred yards wide from the timber line to the glacier meadows or lakes, and piling their uprooted trees, head downward, in rows along the sides of the gaps like lateral moraines. Scars and broken branches of the trees standing on the sides of the gaps record the depth of the overwhelming flood; and when we come to count the annual wood-rings on the uprooted trees we learn that some of these immense avalanches occur only once in a century or even at still wider intervals.

Particularly good examples of forests that have been swept away by avalanches, only to regenerate themselves, may be seen along the trail beside the Lyell Fork of the Tuolumne River, south of Tuolumne Meadows, in Yosemite National Park. In addition to the century avalanches, the results of lesser snow-slides may also be seen here. When

1. From *Natural History* 63(4):190-1, April 1954, reprinted through courtesy of American Museum of Natural History.—Ed.
2. *The Yosemite*, pp. 64-5.

a swiftly moving mass descends upon trees that are already partly buried by stationary snow, they are sometimes snapped off part way up their trunks. The depth of the standing snow can then be guessed from the height of the trees that were beheaded by the avalanche.

(Right) Here the snapped-off trees were buried in stationary snow at the time an avalanche swept past. Their tops were carried away, leaving clear evidence of the depth of the snow at the time of the slide. This is between the Lower and Middle Lyell Base Camps.

Hubbard

(Below) The dip in the tree line shows where a century avalanche swept down the mountain. Younger trees can be seen growing in the path of the avalanche. Their size will indicate how much time has passed since the last slide. This view is along the Lyell Fork of the Tuolumne River, Lyell Canyon.

Hubbard

THE HISTORIC ANDERSON CABIN

By Emil F. Ernst, Park Forester

George G. Anderson, who built and resided in the old cabin illustrated and described here, is best known in the Yosemite story for the first successful ascent of Half Dome in 1875. Several attempts to reach the summit of this formidable granite monolith had been made previously, notably that of James M. Hutchings and Charles L. Weed, the pioneer Yosemite hotel keeper and photographer, respectively, in 1859. Carrying bulky, heavy photographing apparatus, these two were stopped in their endeavor at the saddle on the east side of the massive formation. Half Dome, then better known as South Dome, was considered unclimbable until Anderson, using rope and iron eyebolts inserted in holes drilled in the granite, succeeded in reaching the top. Since then thousands have made the climb, aided by cables installed in 1919, for an outstanding view of Yosemite Valley and the high country.

Early-day artist's conception of George Anderson as he drilled his way up Half Dome's steep granite side.

Anderson made a trail from Happy Isles to Vernal Fall for the State of California. Part of this trail is now in use as far as the bridge below Vernal Fall, the rest of it having been abandoned. Its construction, by 1882, had resulted in considerable financial loss to Anderson. He died a short time after giving up his hopeless task of extending the trail to the top of the fall, which is now reached by a different route.

The Anderson cabin was built of incense-cedar logs some time in the middle 1870's, possibly in 1876. It is a little over 20 feet long and 12 feet wide. It was formerly backed up by a huge boulder, 20 or more feet in height, against which a mud chimney was made for the fireplace. The original roof was removed by Mr. George Meyer when he needed some material, and its nature is not known; however, the custom of the times would lead one to surmise that it was a sugar pine shake roof. A roof of this type was replaced by Mr. Fred McCauley and is the one now covering the structure.

The tiny residence at first was located on property of George Meyer at Big Meadow in a little clearing on the edge of a swampy place, not far from the Indian rancheria. As many as 131 mortar holes, or grinding depressions in the granite rocks used for preparing acorn meal, have been counted at this rancheria, which was known to the Indians as O-*pim*. It is understood that this place-name carried the meaning "halfway between Yosemite Valley and the present Indian Flat on the All-year Highway in the canyon of the Merced River."

McIntyre

Anderson's cabin at site in Foresta

The cabin was used by the two Georges, Anderson and Meyer, during the time that they constructed the latter's homestead residence. This little house was painted white and it succeeded, in a joking way at first, to the title of "The White House." It withstood the storms of many winters and the heat of many summers until August 19, 1936, when a fire consumed it and its contents which included a rather large bearskin.

"The White House" was for some time a United States post office with the name of O-Pim, California. A postal inspector once came up to investigate the unusually small amount of business being reported by this station. He found that George Meyer believed that it was there for his own convenience and that public service was the last thing that entered his mind. Shortly after the inspection the post office of O-Pim was closed.

The old log shelter was well known as "Anderson's cabin." After his death, thought to have occurred in 1883, a controversy sprang up between Thomas A. Rutherford and George Meyer over ownership. The line dividing their properties was indefinite and it was allowed to remain so for a long time. The problem could have been resolved promptly merely by running a compass line from the quarter-corner on either the west or the east side of the section to its opposite on the other side of the section. By the time that Dr. W. A. Setchell, a professor at the University of California in Berkeley, came to Big Meadow in 1909, the great question of the location of the cabin had been settled with the decision in favor of George Meyer.

Dr. Setchell took a liking to the old structure and purchased it from Meyer for $50. He arranged with Fred McCauley to move it, log by log, to its present site in the Foresta subdivision nearby, where Dr. Setchell had acquired home lots. The removal probably occurred in late 1912 or in 1913. By 1929 Dr. Setchell reached the conclusion that he was getting too old to go to the mountains any more, and he felt that the cabin would have a better chance for survival if it were in the custody of the Government. He donated his three Foresta lots and the picturesque old dwelling to the United States in 1929. Since then the unmolested cabin has stood lonely and all but forgotten.