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Cliffs and Trees in Winter - Yosemite Valley

—*Ansel Adams*

Yosemite Nature Notes

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REVEIW

Seismic Explorations on the Floor of Yosemite Valley, California
By Beno Gutenberg, John P .Buwalda and Robert P. Sharp

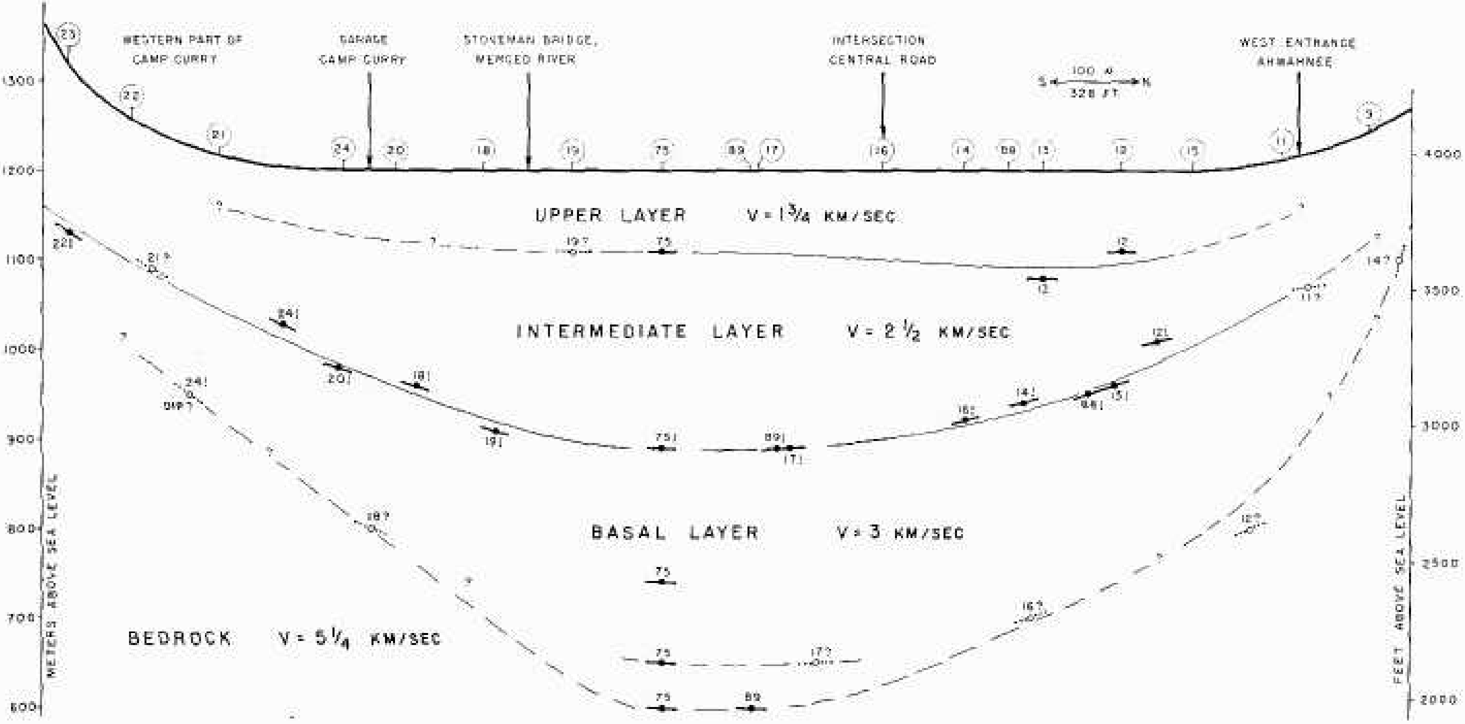
For many years there has been some speculation among geologists as to what the Yosemite Valley would look like if all the loose debris with which it is now partially filled could be cleared out, down to the solid rock. Estimates of the depth of such material have varied from 200 to more than 1500 feet.

In 1935 Dr. Gutenberg and the late Dr. Buwalda undertook to investigate this problem by the use of portable seismographic equipment which had been developed in the Carnegie Institution Seismological Laboratory in Pasadena. Owing to the war and other matters their report was delayed until recently. It has now been published by the Geological Society of America, which had also contributed to the cost of the field work. (*Bulletin of the Geological Society of America*, Vol. 67, pp. 1051-1078, 1956.) The report includes a geological interpretation by Dr. R. P. Sharp. Incidentally the results of this seismic survey reveal some interesting facts about the character of the fill as well as its great depth.

The survey party used a special truck equipped with four seismometers designed by Benioff, as well as an oscillograph and galvanometers. To produce the necessary artificial earthquakes, shallow holes (3 to 50 feet deep) were drilled by a portable drilling machine, and in them small charges of dynamite were detonated electrically. These tests were made at many points along the valley floor, extending from El Portal station and the narrows below Cascade Creek to a point east of Mirror Lake, near Half Dome. The greatest number of shotpoints were situated in the eastern half of that strip.

So sensitive were the recording instruments that the records suffered some interference from the vibrations set up by the tumbling water in the Yosemite Falls and other cascades. On this account the reception was somewhat better in the autumn, when most of the falls were dry.

From the seismograms the traveltimes of the refracted waves were determined, and from these data the velocities of wave propagation in various kinds of material were calculated and tabulated. In the lake deposits velocities were as low as .68 miles per second, while in the granitic rocks the figure was as high as 3⅓ miles per second. From these variations some things can be inferred about the layers of deposit underlying the valley floor, their thick-



PROFILE ACROSS YOSEMITE VALLEY BETWEEN CAMP CURRY AND THE AHWAHNEE
Numbers in Circles Indicate Shot Points

—Ralph Anderson

Yosemite Valley, looking east from Yosemite Falls trail, showing area of profile on opposite page.

ness and their variations from west to east.

The survey revealed the fact that, unlike an ordinary stream-eroded canyon, the Yosemite gorge is marked by three or more elongate basins, of which the easternmost is the largest. In the latter the deepest point (about 1900 feet) is under the meadow east of Yosemite Lodge. The second basin, opposite the Cathedral Spires, has a depth of about 980 feet. The third and shallowest basin is near the mouth of Cascade Creek. From these results it is clear that the glaciers, which occupied the Yosemite Canyon at several different intervals in the Pleistocene period, eroded their beds very unevenly—a habit well known among glaciers in general.

From the variations in wave velocities and wave reflections from certain discontinuities it is inferred that the valley floor is underlain by 3 distinct layers of deposits. The uppermost of these—not over 500 feet thick—consists largely of fine sand with some gravel, which was deposited in a glacial lake. Underneath this there is a layer which some geologists have thought might be glacial till, but which Sharp interprets as more probably an older lake deposit. As no deep wells exist in the valley, no samples of these materials have been taken from greater depths than about 65 feet.

Cross-sections of the valley, constructed from the seismograph data, indicate that the contact between the lowest and the middle layer is strongly concave upward. This fact suggests to Sharp that the earliest deposit was hollowed out to some extent by the next advancing glacier, leaving spoon-shaped depressions in which three temporary lakes were formed; in the latter the sands (?) of the intermediate layer were then deposited.

Sharp finds it puzzling that the deepest part of the valley should be situated on the massive granite rather than on rocks somewhat farther west that are much fractured and therefore would be excavated by the glacier far more easily. He is inclined to favor the suggestion that the configuration of the canyon in the vicinity of the Yosemite Village, as well as the fact that the two main branches of the glacier joined just above that locality, created exceptional erosive power in that area.

The report is illustrated with maps, cross-sections and profiles.

EDITOR'S NOTE: Reviewed by Dr. Eliot Blackwelder, Professor of Geology, emeritus, Stanford University.

SIGN OF MYSTERY

By Jack Fry, Ranger-Naturalist

While driving along the Coulterville Road, Museum Assistant George Heinsohn and I observed a sign which intrigued us. The sign read: "FIRST VIEW OF YOSEMITE--Erected by the Modesto Chamber of Commerce." We looked in the direction indicated by the arrow on the sign in hopes of observing the same scene which the early visitors to Yosemite had seen. All that we saw, however, were trees which had overgrown the vista.

A check of the files of the Modesto Chamber of Commerce and a talk with old timers gave no clue as to when the sign was erected. Mr. A. J. Brandt, Secretary-Manager of the Chamber of Commerce, informed us that "Modesto interests have wanted a direct route to Yosemite for more than 30 years and the sign evidently was part of their project."

Two of the old publications of Yosemite mentioned this view. One in Hutchings' *Guide—Yosemite Valley* of 1895. This book states "Four miles easterly of the Merced Grove the Buena Vista Gap opens before us. Here we obtain our first glimpse of the tops of the peaks, and mountain walls, that encompass Yo Semite, and soon thereafter arrive at some bright, grassy spots known as The Big Meadows."

The other publication is a pamphlet on the Coulterville Road entitled *Yosemite*. This also describes Buena Vista Gap as being four miles beyond Merced Grove. It adds that Buena Vista Gap is 5,150 feet above sea level.

Although both of these were probably written long before the sign was erected they refer, no doubt, to the same location at which the sign now stands.

The only clues we have to the date of placement of this sign are the initials carved upon it, one set of which dates back to 1916.

We know the "who," "what," and "where" regarding this sign. The mystery, then, is *when*. Who can help us?

THE GLACIER MORAINES OF LOWER DANA MEADOWS

By Carl W. Sharsmith, Ranger-Naturalist

Along the south side of the Tioga Road about 3.7 miles eastward from the stone bridge that crosses the Tuolumne River in Tuolumne Meadows, the forest gives way to extensive meadows which afford a full view of Mammoth Peak immediately to the south and of Mt. Gibbs to the east. These openings can here be referred to as the lower Dana Meadows. Scattered among the meadows and forming low yet distinctive hillocks are numerous glacier-moraines which rise fifteen to thirty feet above the irregular grassy strips which separate them one from another.

These moraines are composed mainly of granitic blocks, boulders, cobbles and gravels derived from the slopes of nearby Mammoth Peak, interspersed with varying amounts of cobbles and gravels of gray, red, and black quartzites from the more distant metamorphic masses of Mt. Gibbs and its hidden neighbors to the southeast. With their long axes trending in a roughly north-south direction directly across the meadows, they apparently mark short intervals of pause in the easterly retreating front of the glacier that conveyed them to this point. Evidence that they were deposited by the last glacier to occupy this locality is to be seen in the largely unweathered, sound nature of even the largest granitic blocks, while the angular form of the latter bespeaks of having been derived from a not-too-distant source. Vigorous frost-action, however, operating through the last few thousands of years, has been sufficient to spall away large fragments from the blocks and boulders or even to split some of the largest ones completely apart.

Although most of the moraines are on the far side of the Dana Fork of the Tuolumne River and may therefore be difficult to reach in times of high water, the nearer ones are quite representative and easily accessible. On attaining one of their summits probably the view will first hold one's attention. Conscious of the origin of the eminence on which one stands, one faces the west and sees in the farthest horizon the Hoffman Range which, owing to its north-south trend, shunted a portion of the ancient Tuolumne Glacier into Tenaya Canyon and thence into Yosemite Valley. About-facing to the east the view is dominated by the great mass of Mt. Gibbs which, together with its similarly metamorphic neighbors, formed on its lower, westward slopes one of the most easterly gathering grounds for the snows of the same Tuolumne Glacier.

Turning now to an inspection of the ground under foot, one's attention is claimed by the living inhabitants of the moraine. Here and there is conspicuous evidence of the past work of badgers (*Taxidea taxus*). Pock-marking the slopes in some places are the openings to numerous burrows eight to ten inches in diameter, from which issue banks of "tailings" with occasionally large rocks which seem prodigious but were wholly within the power of this muscular animal to move. The story told is of a wholesale, vigorous attack for food. The food in this case probably having been a large, thriving colony of "picket pins" or Belding ground squirrels (*Citellus beldingi*).

Should the visitor be on the moraines during July or early August, their most remarkable feature will be seen in its best display. This is the occurrence, on these sites, of certain species of flowering plants which otherwise are commonly to be found only at much higher altitudes. One that is sure to catch the eye is the pincushion buckwheat or cushion eriogonum (*Eriogonum ovalifolium*). On the gravelly summits of certain of these moraines the dense, cushion-like mats of this plant are as well developed as at altitudes fully 1500 feet higher on the adjacent mountain slopes. The form of growth assumed is an ages-old adjustment to habitats exposed to draught, cold, and violent winds. The cream-yellow or wine-red heads composed of tiny crowded flowers terminate slender stalks and suggest old-fashioned hat pins stuck deeply in a gray, felty cushion, hence one of the common names.

A complete list of these predominately high alpine plants which inhabit this "low" point is truly surprising. Besides the pincushion buckwheat, it includes also the alpine daisy (*Erigeron petiolaris*), the alpine or Menzies penstemon (*Penstemon Menziesii*), the curiously whiteish dwarf — or alpine — paintbrush (*Castilleia nana*), the alpine champion (*Silena Watsonii*), the alpine fescue (*Festuca brachyphylla*), and the pygmy erigeron (*Erigeron pygmaeus*). The last is especially noteworthy in that it is seldom found at altitudes much below 11,500 feet, and the altitude of these moraines is only about 9,400 feet. It is a well known fact that many of Yosemite's plants are extremely "choosey" as to where they will grow. The pygmy erigeron is one of these and to find it so far below its usual haunts is a rare event indeed. Here on these moraines the rays of this neat pygmy of daisies are as deep a heavenly violet-blue as those far above the tree line (timberline), and the tiny, crowded leaves, often only one quarter of an inch long or less, speak plainly of local conditions as rigorous as those far up on the mountains soaring above.

Of course other plants more "normal" to the altitude of the moraines also occur. Each of these has, however, a very wide altitudinal range in the park. They are not among the "choosey" ones. One of these, namely the brittle bladderfern (*Cystopteris fragilis*) is, in moist crevices, at home all the way from 2000 to 12,000 feet altitude! But how about the choosey ones; why are they here?

One obvious answer is conspicuously seen in the whitebark pines (*Pinus albicaulis*) which, interestingly enough, also occur here and there on the moraines. They are absent in the lodgepole pine forest (*Pinus Murrayana*) which immediately surrounds the meadow. Whitebark pine is characteristic of the treeline (timberline), and treeline in Yosemite National Park lies at an altitude of about 10,800 feet. Thus the presence alone of these pines is suggestive; but what is still more to the point: they are all dwarfed and generally posses a dense, streamlined canopy. Thus they strongly tend to have the form of growth assumed by this species at around 11,300 feet altitude, and thereby reflect the presence here of conditions similar to those of that higher altitudinal level. This evidence is quite in keeping with that of the presence of the high alpine species of plants.

A consideration of the orientation and exposure of the moraines affords strong support for our answer to this effect-and-cause problem. These dry-topped moraines strongly owe the presence thereon of essentially high alpine conditions to the fact that they lie completely athwart and fully exposed to the free, unimpeded sweep of the prevailing westerly and southwesterly winds; winds which often and uninterruptedly blow with gale force, and toothed at times with swarms of sharp-edged snow crystals that with respect to the pines gnaw and cut away shoots which, during favorable periods of growth, have ventured beyond the streamlined contour. For the smaller plants also exposed on the moraines, only those adapted to these conditions can prevail. Hence the presence of the fine cushion plants and others which one would otherwise have to climb much higher up the mountain to see.

—Ansel Adams

Lower Dana Meadows Showing Glacier Moraines Across Center of Photograph.

RAMBLING AROUND THE HALF DOME AREA

By Donald R. Brown, Ranger-Naturalist

As I left Happy isles at 6 a.m. one morning, I thought to myself, "Aren't you the foolish one, starting out to prove Francois Matthes, the eminent geologist who worked out the formation of Yosemite, to be incorrect?" And yet there still remained the conviction that I had seen, on top of Half Dome, a piece of Cathedral Peak granite which could only have come to be there through actions of a glacier. But Matthes' theory held that no glacier had ever overtopped Half Dome. So before starting, I realized that I was attempting to dispute the findings of an expert.

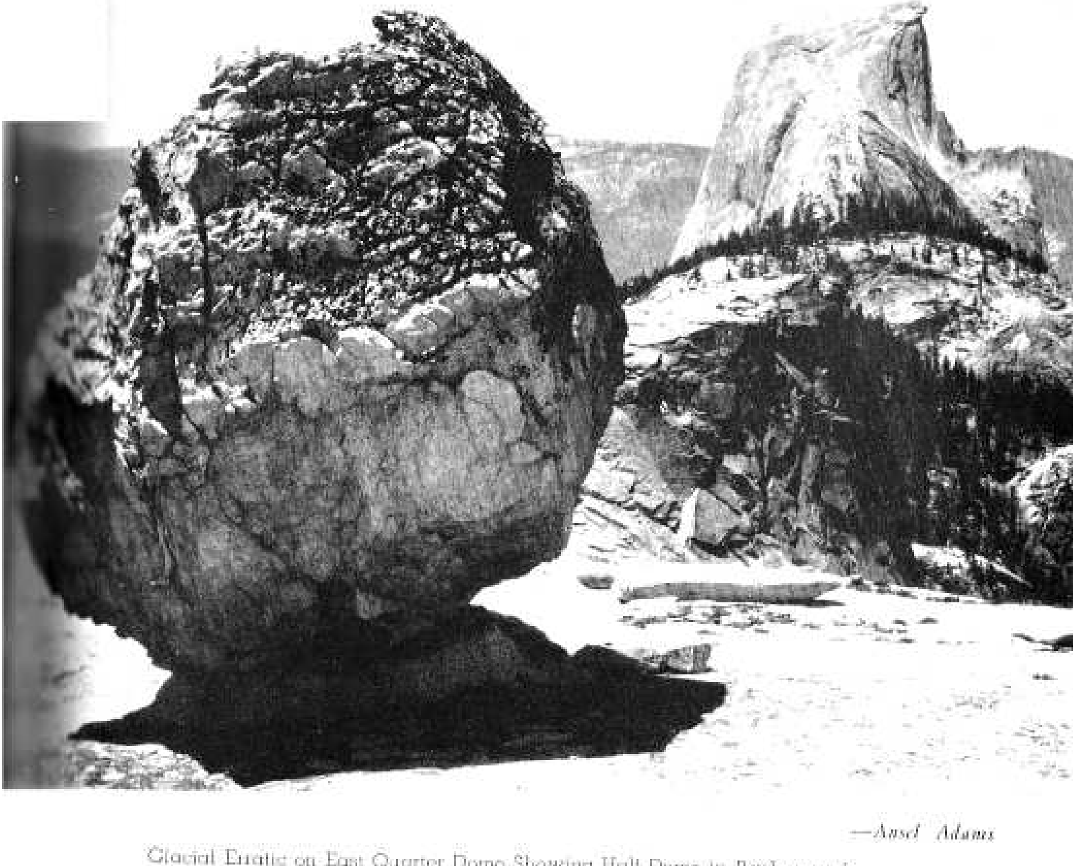
Leaving my pack on Sunrise Creek, I climbed with lunch, binoculars, and a copy of Matthes' book to the summit of Half Dome to commence my search for the possible Cathedral Peak granite. Interrupting my lunch to assure myself that an exhausted climber had made it safely to the bottom of the cables, after giving up the climb as too strenuous, I returned just in time to rescue my food from two hungry golden mantled ground squirrels.

After finishing lunch I explored the summit. It actually consists of two summits, the northern one being somewhat higher and containing the overhang above Mirror Lake. The surface is generally covered with slabs of exfoliated or peeled-off granite or grains of rock into which the solid granite has disintegrated. Three Jeffery pines lend an eerie touch and cause one to wonder how such trees can grow on apparently solid rock.

The southern crown of Half Dome proved to be particularly interesting. As the slope reached an angle of about 25 degrees, it was barren, all exfoliated material having crashed down the cliff. Running irregularly southwest and 6 to 24 inches above the surface of the Half Dome monzonite were many seams of aplite which had successfully resisted the erosional effects of thousands of years. These aplite seams are irregularly weathered, providing a knobbly surface along their length. This surface, with convenient hand and footholds, made exploration of much of the southwest shoulder of the dome possible and must have been what I had earlier construed to be Cathedral Peak Granite. For, in spite of 3½ hours of detailed searching on the summit of Half Dome, I could find no evidence of glaciation, either in the form of glacial scarification or depositional remnants.

My other observations on this little trip strengthened Matthes' theory. Striations, or grooves cut into solid rock by gracially-transported boulders were observed on the back of Mt. Broderick and high up on the walls of Tenaya Canyon. Distinct lateral moraines were crossed on the Sunrise Trail and indistinct morainal material was observed near the top of Sunrise Pass. A large perched erratic boulder was seen on the Moraine Dome and on the Upper Quarter Dome. One on Upper Quarter Dome was observed to have rather recently fallen from its pedestal which has begun to disintegrate, due to the process of weathering.

My trek around Half Dome set my mind at ease that Matthes' theory of glaciation remained intact and provided me with a far better understanding of the formation of the Yosemite area than many hours of study from a book could have done.



—*Ansel Adams*

Glacial Erratic on East Quarter Dome Showing Half Dome in Background.