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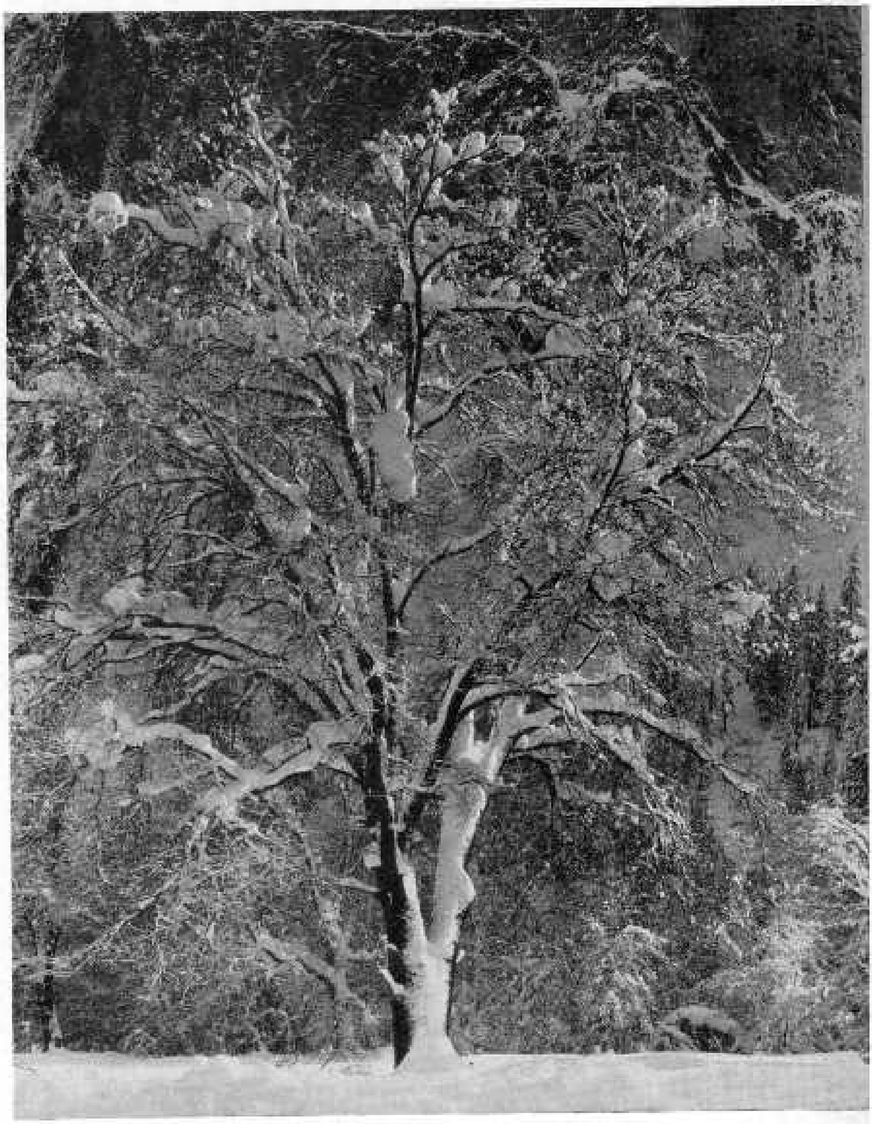

Oak Tree and Cliffs of Cathedral Rocks
—Ansel Adams

Photos by Ralph Anderson

Comparative photos of Dana Glacier taken from the same point during the glacier surveys of 1949 (above) and 1951 (below). Though fresh snow appears in the 1949 photo, the loss of glacial ice in the 2-year period is apparent, particularly on the left (south) flank of the glacier.

Cover Photo: Oak Tree and Cliffs of Cathedral Rocks. By Ansel Adams from "My Camera in Yosemite Valley." Reproduction by kind permission of Virginia Adams and Houghton Mifflin Company.

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THE 1951 GLACIER SURVEY

By Harry C. Parker, Associate Park Naturalist

Another in the series of surveys of Yosemite glaciers begun 20 years ago was conducted from September 23 to October 2, 1951. As a part of the program of the American Geophysical Union, which is in turn coordinated with international studies, the work was done this year by a four-man party from the National Park service staff of Yosemite National Park, augmented by Seasonal Ranger Lawrence Brown on two of his days off.

The regular group comprised Associate Park Naturalist Harry C. Parker, chief of party; Assistant Park Naturalist Norman B. Herkenham, technician in charge of measurements; Junior Park Naturalist Wayne W. Bryant, rodman; and Administrative Assistant Ralph H. Anderson, photographer.

With circumstances preventing a survey in 1950, this year's program was oriented toward continuing the projects set up in the 1949 survey,[1] plus the visitation of two glacierets not hitherto included: Northwest Maclure and North Peak. Comparative photographs were again made of the Lyell, Maclure, Dana, and Conness Glaciers, and measurements of the Lyell Glacier were made from the previously established points near its two lobes. Transverse profiles of these two ice bodies were thus obtained as in the 1949 survey when this practice was initiated, except that this year a regular surveying instrument on a tripod was used in conjunction with a stadia rod, thereby producing much more accurate cross sections than could be obtained in 1949 with hand level and steel tape. Not since 1937 had a tripod-mounted precision instrument been used, when it was applied to a type of measurement later abandoned in favor of the more significant profile measurements.

As was surmised, the unseasonably hot August and September weather had tended to negate the effects of the previous winter's snowfall which had been well above that of 1949, especially in water content. Most of the glacier surfaces were down to bare ice, or the remnants of the season's snow were mere lacy pinnacles. However, in certain more shaded areas, sun cups in the snow were quite evident, giving the usual impression of "waves" frozen in snow.

The plotted profiles of the two lobes of Lyell Glacier indicate a yearly loss of thickness since 1949 of about 1½ feet on the west lobe

1. See *Yosemite Nature Notes*, Vol. XXIX, March 1950, pp. 27-31.

and 3 feet on the east lobe, which also approximate the annual averages over the 18-year period since 1933. However, due to the difference in methods of taking the measurements, making it necessary to weight the curves for 1949, it is not possible to give definite figures. The value of the more accurate method used this year will first become apparent when it is used on the next survey. Then we will have two sets of curves that will afford direct comparison.

The most significant condition discovered was on Dana Glacier. That part of its front opposite the ice chute had several circular pits in the marginal shade ice and its overlying moraine, causing bedrock to be exposed beneath. If the ice in front of these pits melts away during the next season, we can then post survey stations on bedrock from which the real retreat or advance of the glacier's front can be measured in distance. This we have not yet been able to do satisfactorily for our glaciers because their fronts are concealed — buried for unknown horizontal distances under the moraines. It was obvious that Dana Glacier had suffered severe reduction in volume since the last previous survey. The furrows on the upper part were greatly deepened, increasing the "hummocky" appearance. There was a series of ice caves along the north flank where the ice had receded and melted vertically. One of these was examined, and its floor found to be partially made up of bedrock.

The naturalist cabin at Tuolumne Meadows was headquarters for the party. The longest time spent away from the cabin was the 5 days needed for the Lyell-Maclure group, when we were packed in to Upper Lyell Base Camp by Ranger Herbert Ewing. Here the routine was a day-break-to-dark affair. The weather was better than usual, especially as regards the wind, which at times can make for some miserable "housekeeping" conditions.

On the fourth day, after the party made the usual comparative photographs of the Maclure Glacier, Naturalists Herkenham and Bryant were dispatched to investigate the Northwest Maclure Glacieret, which had never been included in previous surveys. Its existence was revealed in an aerial photograph made of the region in 1944. The two men made their way cross country, working along the tops of some steep saddles, often on large, unstable granite blocks. Photographs were taken of this little-known ice body. It is reported in their notes to be "short and very steep, having its lower edge submerged in the small lake between it and its moraine . . . . The moraine was quite shifty, steep, about 150 feet high."

After returning to Tuolumne Meadows for a day of rest following the period at Lyell Base Camp, we visited Dana Glacier as described. Ranger and Mrs. Brown volunteered to accompany us on this trip, it being his off-duty day.

The Conness Glacier was examined on October 1, the ninth day of the survey, with Ranger Brown again accompanying us. This was a very blustery day and therefore quite cool. Storm clouds threatened, but the work was completed without undue interference by the elements. After the comparative photographs were taken from the established points, Messrs. Herkenham, Bryant, and Brown were assigned to try to reach the glacieret perched high on North Peak, hitherto unvisited on glacier surveys. This involved a chilly traverse around the granite spur lying between the Conness and

North Peak cirques, but they were successful in the attempt. They brought back some interesting photographs, including pictures of ice columns which filled vertical chimneys in the cirque wall above the glacieret. It is believed that this phenomenon aids in the formation of many "fluted walls" found elsewhere in the Sierra, which are now devoid of massive ice. They reported as follows: "Evidence indicates this ice body has died or is very nearly stationary. First small lake below it contains very little glacial flour; ice has small size, appears quite thin. No bergschrund." It is important to have this information about the actual nature of the glacieret, because, except for the last few years, when snowfall has been below normal, it had been thought that this was no more than a permanent snowfield. In recent years photographs taken from a distance indicated that it was mainly made up of ice.

By the time this party rejoined the other two members of the group they were nearly blue with cold, for storm clouds had blotted out the sun and a strong, chilling wind had been blowing for about two hours. Hot coffee, graciously dispensed by the cook at the tungsten mine headquarters on Saddlebag Lake, served to restore everyone to tiptop shape, ready for the slow drive back to Tuolumne Meadows for a late supper. So ended the last day of the 1951 glacier survey.

Final comparisons have not been made nor the final report sent to the International Committee on Glaciers, but the trip this year can already be appraised as being pre-eminently worthwhile. A base was laid for more accurate figures on the shrinkage in volume of the Lyell Glacier. The photographs, especially of Dana Glacier and the two glacierets, are very useful. The data thus obtained will be especially valuable should we now be headed into another "wet cycle" with normal or above normal snowfall during the next few winters. Some of the fundamental things we have noted about the nature of our glaciers could be revealed only after a season like the one in 1951, with extreme melting down into the ice itself.

MRS. ELIZABETH MEYER PASSES

By Ralph H. Anderson, Administrative Assistant

The passing of any old-timer is saddening to all of us, but especially so when the person has endeared herself to so many as had Mrs. Elizabeth Meyer of Big Meadow.

A great many people have chatted with Mrs. Meyer on the front porch of her picturesque ranch house, flanked by great stretches of green meadowland and facing an apple orchard so attractive in spring bloom. Mrs. Meyer maintained that sparkle of enthusiasm and good Irish humor throughout her exceptionally interesting life.

She died on Friday, January 25,

in the John C. Fremont Hospital in Mariposa, at the age of 85. Known to her many friends as "Granny," she was born Elizabeth Stuart McCauley in Liverpool, England, on July 25, 1866. An orphan at the age of 3, she was raised by two aunts near Belfast, Ireland, and lived with them until she was 18.

Mrs. Meyer arrived in this country from Belfast in July 1884 to make her home with her uncle, James McCauley; his wife, the former Barbara Wenger; and their sons, Jules, Fred, and John. In an interview in July 1948, she vividly recalled her uncle, who sent her a ticket and $50 cash to make the trip to Yosemite. McCauley had built and was operating the Glacier Point Mountain House and the Four Mile Trail leading to it from Yosemite Valley. The Mountain House still accommodates tourists visiting the park.

Arriving at Merced, Mrs. Meyer took the mail coach to Hornitos with John McCready, driver; then from Hornitos to Mariposa with Percy Gallison, and from Mariposa to Wawona with Tom Farnsworth. All of these names are prominent in Mariposa County history. She arrived in Wawona at 3:00 a.m. and took the stage to Leidig's in Yosemite Valley, thence via the Four Mile Trail by saddle horse the same day to her uncle's hotel at Glacier Point.

Mrs. Meyer later worked for W. E. Dennison, guardian of Yosemite Valley and Mariposa Grove under State administration.

In 1900 she was married to George Meyer, who had settled the Big Meadow ranch in 1870. There the three Meyer children were born. Hazel died in June 1905 at the age of three and was buried in the Yosemite Cemetery; George was killed in a freak accident with a horse at Merced Falls on April 1, 1939; and Horace now resides at Cathay and at Big Meadow. Her husband died in 1917. Since then she has shouldered the responsibility as head of the household and became an astute businesswoman.

Photo by Ralph Anderson

Mrs. Elizabeth Meyer in March 1948

Besides her son Horace, Mrs. Meyer is survived by four grandchildren: Peggy, of Mariposa, and Betty, George, and Patsy, of Cathay.

Funeral services were held at Our Lady of Mercy Catholic Church in Merced, at 9:30 a.m. Tuesday, January 29, with burial in the family plot in Calvary Cemetery. In accordance with Mrs. Meyer's wish, park rangers from Yosemite served as pallbearers. The group consisted of Arthur G. Holmes, Samuel L. Clark, Homer W. Robinson, Ralph H. Anderson, Henry R. During, and Herbert B. Ewing.

AVALANCHE — A THRILL AND A HAZARD

By Wayne W. Bryant, Junior Park Naturalist

John Muir thrilled to the sound and spectacle of occasional avalanches during his winters in Yosemite Valley in the 1870's. Even today it is a rare and exciting experience to hear and observe snow masses cascading down the walls of the valley—an experience that relatively few Yosemite visitors are fortunate enough to have, because only occasionally do the proper causative conditions exist. A snow avalanche in the valley is ordinarily of minor proportions, but it is, nonetheless, a fascinating and unusual phenomenon to observe. Most of the major avalanches in the Sierra Nevada occur in the rugged and snowbound high country and are therefore unseen by human eyes.

The 1952 winter season has been particularly productive of snow avalanches in the Sierra due to an abnormal abundance of snow. Though there is no apparent danger from the avalanches in Yosemite Valley, they are a real hazard in the higher areas of the Sierra in relation to all-year highways, buildings, and to skiers especially.

On January 24 and 25, 1952, the sound of avalanches filled the air in Yosemite Valley. One after another, rumble after rumble, the snowslides tumbled down its cliffs. Conditions were ideal for wet-snow avalanches: heavy snowpack, warm temperatures, and 2 days of rain. Under such conditions the snow masses clinging to the valley walls developed a wet, slickened undersurface, allowing gravity finally to overcome the adhesion between snow and steep, smooth granite. Then down came the cascades of snow.

After hearing the initial muffled report of an avalanche, natural curiosity usually turns the observer to searching the cliffs for the source of the sound. If sufficiently alert he may be rewarded with a view of the sliding snow mass. In many cases he might fancy that he had spotted a new waterfall rather than a snowslide, for there is a striking resemblance, except that the snowslide has an abrupt beginning and ending and a very brief duration. The observer seldom sees the beginning of these small avalanches except by sheer accident, for the snowslide is well on its brief way by the time the first sound reaches him and calls his attention to it. The slides seldom last longer than a minute. Snowslides cascade down over the cliffs, sometimes sliding, sometimes leaping free into the air over vertical precipices, and finally come to rest in cone-like form on a wide ledge or on a talus slope below.

Most avalanches follow regularly established paths in chutes or gullies (or couloirs). In most cases, the chutes have been carved entirely or in part by repeated avalanches through the centuries. Several chutes along Yosemite Valley's walls are commonly subjected to one or more minor avalanches each winter. Among them: The Yosemite Point couloir; the gully west of Three Brothers; the couloir west of El Capitan; the chutes adjacent to Stanford, Crocker, and Dewey Points; the chutes between Taft Point and Cathedral Rocks; and a gully on the east side of Glacier Point.

Perhaps the largest avalanches near Yosemite Valley occur on the broad, steep slopes of the face of

Photo by Ralph Anderson

A typical avalanche path is the Yosemite Point couloir, seen as the long shadowed recess near the right edge of this photo of Upper Yosemite Fall.

Clouds Rest, where they often descend 3 or 4 thousand feet in altitude and a mile in distance before coming to rest near the bottom of Tenaya Canyon. When conditions were just right in early spring, often several avalanches have been seen on Clouds Rest in a single day. Since the disappearance of the ice age glaciers, according to the late Francois Matthes, snow avalanches have been the principal agency in eroding and shaping the massive granite face of Clouds Rest, forming the shallow tunnels and undulations that we see on its surface today.

The early Sierra surveyor, Clarence King, described a series of avalanches from the walls of Yosemite Valley in November 1864:

> For half an hour nature seemed in entire repose; not a breath of wind stirred the white snow-laden shafts of the trees; not a sound of animate creature, or the most distant reverberation of waterfall reached us; no film of vapor moved across the tranquil sapphire sky; absolute quiet reigned until a loud roar proceeding from El Capitan turned our eyes in that direction. From the round, dome-like cap of its summit there moved down an avalanche, gathering volume and swiftness as it rushed to the brink, and then, leaping out two or three hundred feet into space, fell, slowly filtering down through the lighted air, like a silver cloud, until within a thousand feet of the earth it floated into the shadow of the cliff and sank to the ground as a faint blue mist. Next the Cathedral snow poured from its lighted summit in resounding avalanches; then the Three Brothers shot off their loads, and afar from the east a deep roar reached us as the whole snow-cover thundered down the flank of Clouds Rest . . . . Sleet and snow and rain fell fast, and the boom of falling trees and crashing avalanches followed one another in an almost uninterrupted roar.[1]

James Hutchings, one of Yosemite's first residents, was impressed with winter and its phenomena in the valley:

> Speechless with admiration, even while we were gazing upon it, a new revelation dawns upon us, for everywhere around we hear rushing, rattling, hissing, booming avalanches come shooting from the mountain-tops, adown precipitous hollows, and creating fresh sources of attraction; with new combinations of impressions, that must be alike diverting and satisfying to both artistic and poetic feeling. Then, before these sounds can have been repeated in echoes, and hurled from wall to wall, or from crag to peak, another avalanche makes the leap; and, like its predecessor,

1. King, Clarence. *Mountaineering in the Sierra Nevada*, pp. 179, 181.

indicates the birth of a new water-fall, in some strange and unheard-of place.[2]

John Muir found a fascination in watching valley avalanches and makes many interesting references to them in his works, a few of which are quoted here:

Storm succeeds storm, heaping snow on snow. From the canyon-walls and long white slopes of the mountains avalanches descend in glory, laying bare the very roots of mountains and domes.[3]

An imposing snow avalanche fell from the narrow gorge east of Yosemite Fall, lasting more than a minute. It was at first a homogeneous roaring mass of dazzling brightness, then most of the back-streaming, enveloping snow-dust disappeared and the body of the avalanche was seen as distinct in structure and motion as a waterfall, thinning until the gray rock showed through, then leisurely closing.[4]

As the storm progresses, the thickening flakes darken the air, and soon the rush and muffled boom of avalanches are heard, but we try in vain to catch a glimpse of them until rifts occur in the clouds and the storm ceases. Then, standing in the middle of the valley, we may witness the descent of half a dozen or more within the space of a few minutes or hours, according to the abundance and condition of the snow.[5]

After snow-storms come avalanches, varying greatly in form, size, behavior and in the songs they sing; some on the smooth slopes of the mountains are short and broad; others long and river-like in the side canons of yosemites and in the main canons, flowing in regular channels and booming like waterfalls, while countless smaller ones fall everywhere from laden trees and rocks and lofty canon walls. Most delightful it is to stand in the middle of Yosemite on still clear mornings after snow-storms and watch the throng of avalanches as they come down, rejoicing, to their places, whispering, thrilling like birds, or booming and roaring like thunder . . . . Hundreds of broad cloud-shaped masses may also be seen, leaping over the brows of the cliffs from great heights, descending at first with regular avalanche speed until, worn into dust by friction, they float in front of the precipices like irised clouds. Those which descend from the brow of El Capitan are particularly fine; but most of the great Yosemite avalanches flow in regular channels like cascades and waterfalls. When the snow first gives way on the upper slopes of their basins, a dull rushing, rumbling sound is heard which rapidly increases and seems to draw nearer with appalling intensity of tone. Presently the white flood comes bounding into sight over bosses and sheer places, leaping from bench to bench, spreading and narrowing and throwing off clouds of whirling dust like the spray of foaming cataracts.[6]

John Muir held a distinction that can be claimed by few—a successful ride on an avalanche! The exhilaration of such rapid descent must rival the thrill of schussing down a steep ski run. But let John Muir describe it to you:

In all my mountaineering I have enjoyed only one avalanche ride, and the start was so sudden and the end came so soon I had but little time to think of the danger that attends this sort of travel, though at such times one thinks fast. One fine Yosemite morning after a heavy snowfall, being eager to see as many avalanches as possible and wide views of the forest and summit peaks in their new white robes before the sunshine had time to change them, I set out early to climb by a side canon to the top of a commanding ridge a little over three thousand feet above the Valley. On account of the looseness of the snow that blocked the canon I knew the climb would require a long time, some three or four hours as I estimated; but it proved far more difficult than I had anticipated. Most of the way I sank waist deep, almost out of sight in some places. After spending the whole day to within half an hour or so of sundown, I was still several hundred feet below the summit. Then my hopes were reduced to getting up in time to see the sunset. But I was not to get summit views of any sort that day, for deep trampling near the canon head, where the snow was strained, started an avalanche, and I was swished down to the foot of the canon as if by enchantment. The wallowing ascent had taken nearly all day, the descent only about a minute. When the avalanche started I threw myself on my back and spread my arms to try to keep from sinking. Fortunately, though the grade of the canon is very steep, it is not interrupted by precipices large 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 at times a little below it, and covered with a veil of back-streaming dust particles; and as the whole mass beneath and about me joined in the flight there was no friction, though I was tossed here and

2. Hutchings, James M. *In the Heart of the Sierras*, pp. 494-5.
3. Muir, John, edited by Linnie Marsh Wolfe. *John of the Mountains*, p. 87.
4. Ibid., p. 119.
5. Ibid., p. 124.
6. Muir, John. *The Yosemite*, pp. 62-3.

> there and lurched from side to side. When the avalanche swedged and came to rest I found myself on top of the crumpled pile without a bruise or scar . . . . This flight in what might be called a milky way of snow-stars was the most spiritual and exhilarating of all the modes of motion I have ever experienced. Elijah's flight in a chariot of fire could hardly have been more gloriously exciting.[7]

An avalanche is defined as the sudden falling and sliding of a large mass of snow, ice, earth, or rock in swift motion down a mountainside or over a precipice. The usual connotation of the word refers to the variety made up of snow, but more accurate terminology would be "snow avalanche" as distinguished from "rock avalanche." Rock avalanches have played a major role in the recent geologic history of Yosemite Valley, but here we are concerned with snow avalanches—those caused by the instability of snow masses.

Snow avalanches may be classified by snow condition and by time and frequency of occurrence. As to the latter, John Muir mentions three types:[8] (1) After-storm avalanches, (2) annual avalanches, and (3) century avalanches. The after-storm avalanches are frequent in all of the deep, steep-walled canyons of the Sierra. The annual type is developed on mountain slopes from 9,000 to 10,000 feet at an angle too gentle to shed dry winter snow, but spring thaws loosen and smooth out the bottom layers of the accumulated snow mass until it slides. The avalanches on the face of Clouds Rest are of this variety. Century avalanches occur on mountains from 10,000 to 12,000 feet, where the snow may accumulate from year to year over a period long enough for trees to grow below the snow mass. When this avalanche breaks loose it destroys the trees as it moves. There is evidence that such avalanches occur but once in a century or longer, as determined by counting the rings of the shattered trees.

Snow avalanches may be classified also by snow condition, into (1) Dry-snow avalanches, (2) wet-snow avalanches, (3) wind-slab avalanches, and (4) ice avalanches. Dry-snow avalanches are after-storm avalanches in which the bond between adjacent snow crystals is lost by evaporation of the crystal branches, thus permitting the snow to flow. Wet-snow avalanches may occur when new snow becomes very sticky or when old snow becomes heavily water-soaked from rain or melting. The wet old-snow avalanches usually tend to slide in the same tracks each year. A wet new-snow avalanche may slide or roll into huge balls as it descends a slope. Wind-slab avalanches consist of blocks of wind-crusted snow which become detached from looser underlying snow and roll down steep slopes. Ice avalanches do not occur in the Sierra Nevada, but in precipitous regions of heavy glaciation.

The speed of avalanches is dependent upon the volume and type of snow and the smoothness and slope of the underlying surface. Wet snow is the slowest and dry powder snow the fastest. A typical wet-snow avalanche on a 45° slope was estimated at 17 miles per hour, while a great powder-snow avalanche on a 44° slope in the Alps was estimated at 217 miles per hour. Slopes steeper than 22° are likely to be subjected to avalanches, but slopes even as little as 15° have produced wet-snow avalanches.

One of the earliest written records concerning the destructive power of avalanches was written by Silius

7. Ibid., pp. 65-7.
8. Ibid., pp. 63-5.

(Roman epic poet, A.D. 1st century) concerning Hannibal's crossing of the Alps (3rd century B.C.):

> There, where the path is broken by the gleaming slope of the hill, which the cold has frozen solidly, he [Hannibal] pierces with his iron the ice which resists; the detached snow hurls men into the chasm, and falling with violence from the high peak buries the squadrons alive.[9]

For many centuries, snow avalanches have been a great hazard to humans and their habitations in the Alps of central Europe. It is not surprising, then, that the science of snow structure was developed in the region of the Alps. With the advent of skiing popularity in the United States, the avalanche hazard has become a real problem to contend with in our country. The U.S. Forest Service in the Wasatch Mountains of Utah, and Meteorologist J. E. Church in the Sierra Nevada, have pioneered the study of snow structure and avalanches in the western United States, and through their research are making mountain slopes safer for skiers.

9. Thorington, J. Monroe. "Alpine Dangers in the Sixteenth Century," *Sierra Club Bulletin* Vol. 17, p. 40.

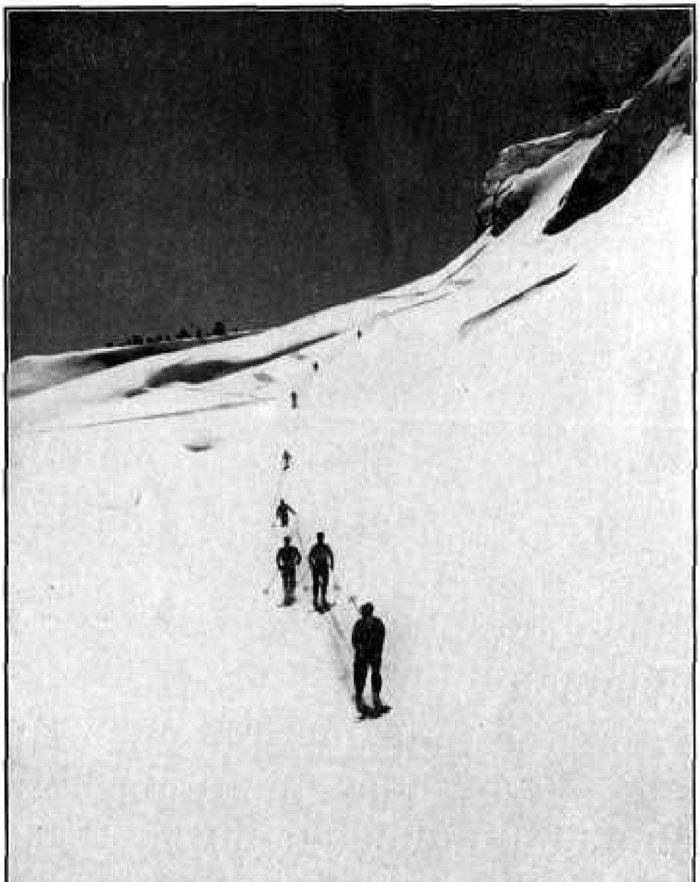

Photo courtesy of Yosemite Park and Curry Company