

"Mount Lassen Is In Eruption And There Is No Mistake About That"

By MARY R. HILL

Illustrations by Elinor H. Rhodes

With these words the *Shasta Courier Free Press* of Redding heralded the first volcanic eruption in the history of the United States.

The first blast was at 5 P.M., May 30, 1914—a day marked as Memorial Day, but for other reasons—and, as luck would have it, Bert (Ike) McKenzie, of Chester, was looking directly at the mountain when it blew.

Although the oral history and traditions of the early inhabitants of the Lassen area include several accounts of volcanic eruptions, and although early explorers of the West easily recognized the volcanic recency of the landscape, this was the first erupting volcano to be seen since there had been 48 United States.

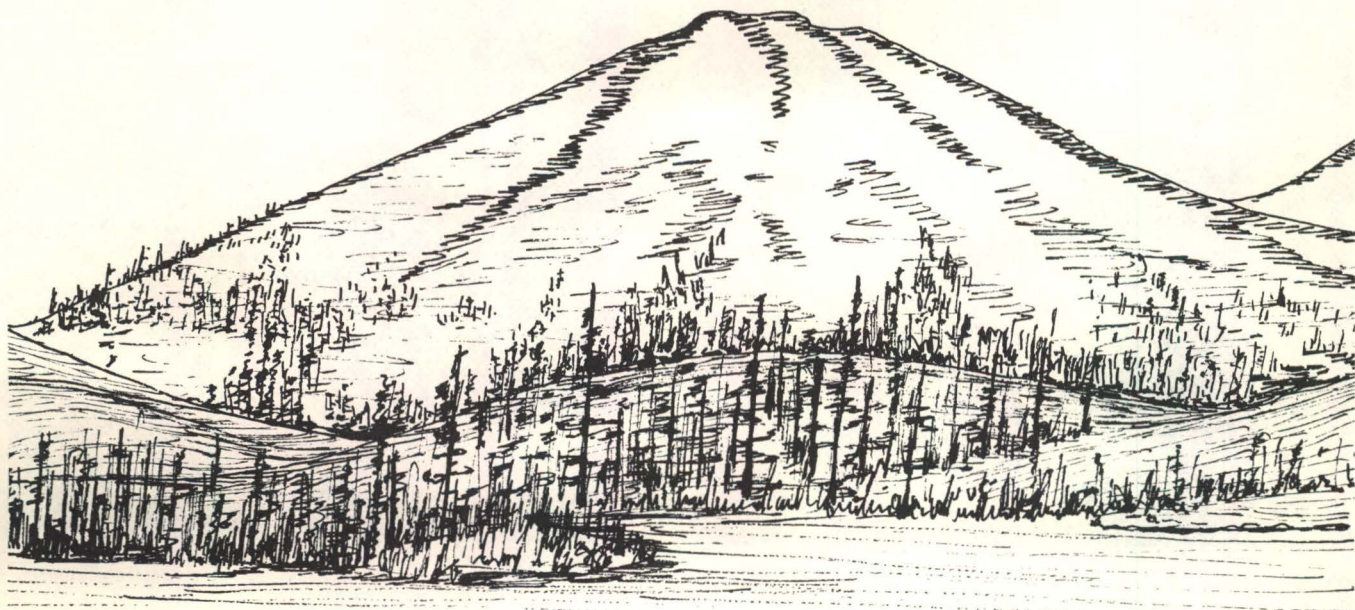
There were, to be sure, volcanoes in the remote Alaskan Territory that occasionally belched—the 1912 eruptions in what is now Katmai National Monument were among the world's greatest—and volcanoes of the far Pacific Islands of the Hawaiian group seemed always to be hot, but this was the first accessible volcanic eruption for most Americans.

On the strength of this first blast and the long series that followed, Lassen was billed until recently as "the only active volcano in the United States," a statement that was, then, only half true, and is not true at all now that there are 50 of these United States.

The Lassen volcano came to the attention of the country at a time when the Great American outdoor recreation—sightseeing—was starting its upward trend, and when "going to California" not to seek gold, but just to see, was on a parallel course. "Rubbernecking", O. Henry had called it a few years before; and there were rubberneckers aplenty at Lassen, even then.

My own mother was among them. Having caught the "see California fever", and being an old hand at rubbernecking (in the 1890s, she had walked 40 miles and back to see an automobile), she set off from San Francisco to see the volcano. The first part of the trip, by train, was easy, comfortable, and hot. The second part, on the stage from Red Bluff to Mineral, was hot and unbelievably dusty. From Mineral, it was a sizeable walk, as it is now, to Lassen. But she was rewarded by a good view of the mountain steaming—a view she told me about often in her lifetime, and a view I wish I'd had.

In 1914, and, for that matter, now, the area around Lassen was sparsely settled. The volcano did not bury cities or kill thousands of people—partly because there were no cities and few people, and partly because the volcano did not produce much dangerous gas or hot lava. One building on top of the mountain was blown apart and one man was injured; but the most potentially disastrous phase of the eruption—the blast



and mud flows of May, 1915, which produced the "Devastated Area"—destroyed only a ditch and some farm buildings and covered grazing land.

Nevertheless, these explosions were, as Arthur L. Day observed, "of sufficient violence to have overwhelmed a small city in case it happened to be located in Lost Creek Valley."

Local residents of the Lassen region took considerable pride and interest in the volcano. Some made careful notes on all phases of the eruptions, from their inception in 1914 to the "great clouds of white steam" sent up from the eastern fissures in 1921. The U. S. Forest Service, in official charge of most of the area, as it was then within the bounds of Lassen National Forest, kept careful records throughout, and investigated the crater after each period of activity. They watched in summer from the top of Brokeoff Mountain, 4 miles west of Lassen, and in winter from Mineral, 15 miles south. The summer watch atop Brokeoff was not solely for monitoring the eruptions; its chief purpose was as a fire lookout—a purpose served by Lassen until the eruptions of the summer of 1914 literally blew the Lassen lookout house apart.

From Chester, 20 miles east, George W. Olsen reported on the progress of the eruption; from Manton, 20 miles west, Alice Dines, Postmistress, kept unceasing watch from beginning to end. In addition, Benjamin Franklin Loomis, professional photographer and lumberman, produced an incomparable photographic history of the volcano, from which many of

these drawings were made. His base of observation was Viola, 7 miles west, in summer; Anderson, 45 miles west, in winter.

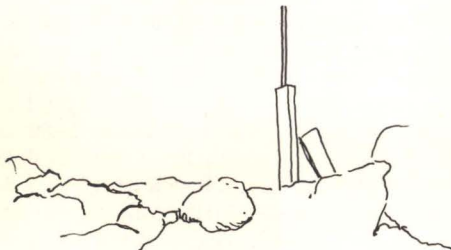
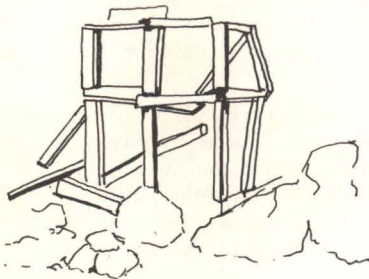
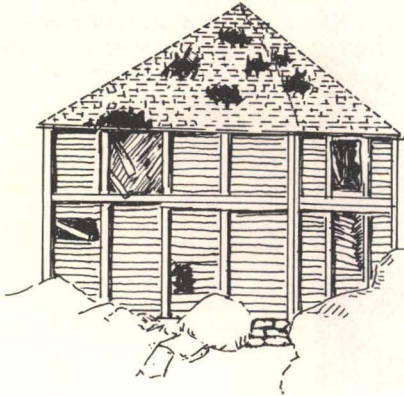
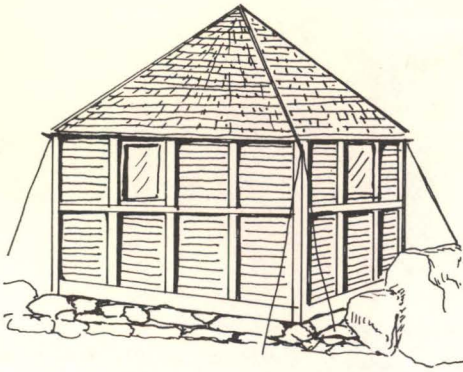
Although there were no trained, professional geologists on steady volcano watch, these volunteer watchers soon became experienced, and there are geological "before and after" portraits of the mountain by competent men. Fortunately, Lassen Peak was one of the few areas in California to have been studied and mapped geologically on a fairly large scale before 1914.

In 1883, when a young man of 33, J. S. Diller first visited Lassen's crater; this visit and subsequent ones were the basis of his study of the mountain, which culminated in publication of "The geology of the Lassen Peak district" in 1889; this was followed by the "Lassen Peak folio" issued in 1895 by the U. S. Geological Survey as number 15 in what was intended to be the geological atlas of the United States. His map, on a scale of 1:62,500, (1 inch = 1 mile) shows the mountain as it was before this last, Twentieth Century eruption.

In June, 1914, when word reached Washington that the mountain was demonstrating, Mr. Diller was sent to revisit the scene of his earlier studies to report on the status of the volcano. Although he was forty years older, he did not hesitate to climb the volcano again to re-view the crater. After the great blast and mudflow of the next year, Diller again returned to the mountain, arriving early in July of 1915. This



Lassen Peak from Chaos Crags as it appeared in the late nineteenth century, before the latest eruption. Photo by C. E. Watkins, courtesy U.S. Geological Survey.



time he walked the Devastated Area to see the havoc wrought by the flow.

While he was still there, Arthur L. Day arrived, also to make a study of the volcano and of the hot springs associated with it. His book, "The volcanic activity and hot springs of Lassen Peak," written in collaboration with E. T. Allen, is an interesting, careful summary of geologic work in the Lassen area up to 1923.

Between Diller's visits, Professor R. S. Holway of the University of California climbed the mountain, publishing his own papers on the eruption of 1914 and collaborating on those of 1915 with Diller.

Since then, numerous papers have been written on the area or special features of it; notable among them is "Geology of the Lassen Volcanic National Park, California," by Howel Williams, published by the University of California in 1932; various issues of *The Volcano Letter*, containing reports on Lassen by R. H. Finch; and the geology of three new 15-minute quadrangle maps—(Manzanita Lake, Prospect Peak, and Harvey Mountain) by Gordon A. MacDonald. All of these last are, of course, post mortem insofar as the eruptions are concerned.

The first year of eruption was fairly quiet, although the volcano was very active, sending up clouds of "smoke", and scattering ash as far as the town of Mineral. Observers logged 170 eruptions during this period. It is entirely likely that twice that many or more actually took place, as much of the winter the mountain was covered by storm clouds that hid eruptions; also, there can be no doubt but that a large number of eruptions took place unseen at night. Many of these nighttime explosions were, however, included in the log, as, for example, the eruption of the night of April 12-13, 1915,

Five stages in the destruction of the lookout atop Lassen Peak, 1914.

Top. The lookout as it was before the eruption. William C. Hodge, writing in the *Sierra Club Bulletin*, called it "one of the most interesting buildings in California, even before its destruction." Designed by Forest Supervisor Kling, it had been prefabricated in Red Bluff, then dismantled and taken to its location atop Mt. Lassen, a quarter of a mile from the crater and 500 feet above it. As it was back packed the last few miles, no part was too awkward or heavy to carry. It represented the very latest design of its time: a "ribbon of glass extended completely around the cabin", allowing the lookout a full 360-degree view. Since winds were known to be strong atop the mountain, it was a tribute to Supervisor Kling's design and its execution that the cabin was strong enough to withstand almost everything.

In the drawings and the photos they were made from, the "ribbon of glass" is seen as one window on each side, but since eruptions started before the lookout went to his post for the summer, most of them were still shuttered against the winter storms.

Second from top. The roof of the cabin had been punctured by rocks. One had fallen on a rafter, slicing it through.

Center. Further demolition of the cabin before its destruction (*next to bottom*) by October 20, 1914, following 72 eruptions. (*Bottom*) By August 8, 1915, after 192 eruptions, only a pole remained to mark the site.

A new cabin was built on Brokeoff Mountain in 1914 from which rangers could watch the eruption of Mt. Lassen as well as for forest fires.



Mt. Lassen in 1911. Early travelers must have seen a view such as this, as there is no record of eruption of the peak in the nineteenth century. This is the Devastated Area before the eruption.

which was reported by Charlie Yori from Drakesbad, as a "heavy fall of ash during the night." Although ash falls never became dangerous, they were noticeable; Miss Dines, working in her garden in Manton on April 30, 1915, held up a paper to catch ash, and succeeded in recovering half a teaspoonful in about 10 minutes. Had it not been that she was gardening at the time, and noticed volcanic ash falling in her hair, this eruption, although it happened in daylight, might never have been logged at all, as it took place when the mountain was hidden by a storm.

None of the material ejected from the volcano during this phase was very large; it consisted principally of small rocks and lapilli. No heavy boulders were thrown much beyond the crater rim, and none of the ejecta was hot enough to melt the snow it fell upon.

The volcano was behaving in a singularly circumspect fashion during this period, yet this was the only time in which anyone was hurt. Were Lassen Mt. Olympus, one might conclude that the one injured man—Lance Graham—was a victim of *hubris*, for he was hit by a rock after having stared into a crater during an eruption, in spite of warning sounds issuing from it. He, too, was a rubbernecker.

He was in a party of three mill crew workers, led by R. E. Phelps, who climbed Lassen during the eruption of June 14th, at the same time that B. F. Loomis was making a remarkable series of negatives showing six views of the eruption.

Mr. Loomis was worrying about them, and with good reason; for as Mr. Phelps and his men were standing on the crater, the volcano gave a mighty belch of black "smoke", and threw out a thick shower of ash and rock. Mr. Phelps hid under an overhanging rock; Jim Riggins ran down the mountain to a snowslope, where he was involuntarily propelled beyond range of the larger rocks, but the cloud of ash kept pace with him, obliging him to bury his face in the snow

in order to breathe. Lance Graham, the third member, was hit by a rock and knocked unconscious. His companions carried him down the mountain, thinking him dead, but his injuries were not mortal—only a broken collar bone and a flesh wound.

Spring began to come to the crest of Lassen in May of 1915. The snows, which had been unusually heavy that year, commenced to melt, and may have provided the trigger-action for the spectacular eruptions of late May. By the 16th or 18th, Miss Dines was able to discern a small black mass rising into the cleft in the rim on the western summit. By the night of the 19th, the mountain was ready to provide a spectacle of red hot "fireworks" that G. R. Milford, manager of the Volta plant of the Northern California Power Company, 21 miles west of the peak, described graphically in a letter to Mr. Diller:

"About 9:15 P. M. word was sent in by telephone that Lassen Peak was in eruption and fire could be seen coming from the crater. In company with Mr. and Mrs. Chas. R. Milford, Miss Catherine Milford, Mr. C. E. Johnson, Mr. and Mrs. F. A. Dooley, Mr. and Mrs. Geo. Risley, the writer went to a point of vantage about 100 yards southeast of the power house, where an unobstructed view of the peak could be had. . . .

"Our attention was first drawn to the deep-red glow which appeared over the crater and was of sufficient intensity to illumine the entire outline of the mountain top. There was no moon, the heavens were clear, yet this glow was bright enough to be reflected in the dense clouds of steam and smoke arising from the crater. From time to time the glow seemed to change in brilliancy, now brighter, now dimmer—this variation due, no doubt, to the varying density of the clouds of steam and smoke issuing from the crater.

LANCE GRAHAM TELLS HOW IT FEELS TO BE HIT BY AN ACTIVE VOLCANO

(Condensed from the *Shasta Courier*)

Lance Graham, the most seriously injured of the party of daring explorers who were caught Sunday morning in the eleventh eruption of Mt. Lassen, is resting comfortably in the hospital. He is the only man who ever looked into the crater of an active volcano five minutes before the eruption and lived to tell the tale.

When seen by a *Courier Free Press* reporter Tuesday morning, Mr. Graham said: "Our party, consisting of F. A. Tipple, R. E. Phelps and myself, prompted by curiosity pure and simple, left Manzanita Lake early Sunday morning for the purpose of viewing the crater at close range. The ascent of the mountain was a strenuous task, as in places the snow was very deep. Where there was no snow the side of the mountain was so rough and jagged that we reached the summit with great difficulty.

"As we stood on the rim of the crater looking into the irregular great cavity, the three of us became nervous. I climbed a higher point than the others. Perched on a high rock, I was seized with a premonition of the impending danger, and my one impulse was to get away. Somebody suggested that we beat it. I was entirely agreeable to this, but for some unknown reason, though the others started down the mountain at once, I remained behind for about three minutes.

"Just as I turned to leave the crater's rim, there was a puff of blue smoke, followed by a tongue of red flame that resembled the discharge of an old fashioned cannon. My impression is that there was a dull rumble accompanying this outbreak, but of this I am not certain. I started to pick my way down the mountain, but in a trice I was enveloped in a cloud of smoke, while a perfect hail of small volcanic bombs and cinders beat down upon me. Then I was struck by a stone about twice the size of my fist that felled me to the ground.

"My senses gradually left me and I seemed to be floating out into space where all was peaceful and calm. I have no idea of how long I lay on the mountain side, but I was conscious of the fact that my companions had left me for dead. I was paralyzed; at least my vocal organs refused to respond to my efforts to articulate. When the eruption was over and the atmosphere cleared, my companions made a search for me, finding me completely covered with ashes and cinders. They started to carry my supposed dead body down the mountain.

"At this time I was fully aware of what they were doing and of the fact that they thought me dead. I cannot explain this, but it seemed to me that I was for the time being a disembodied spirit, viewing its own body from another sphere of existence."

Lance Graham was struck by a flying rock.

Mr. Phelps hid under an overhanging cliff.

Jimmy Riggings ran down the mountain . . . and slid down a snowdrift.



WHAT IF LASSEN ERUPTS AGAIN?

About 3 million years ago the ancestral Lassen volcano was one of the most active volcanoes in the world. Life in much of the Sacramento Valley, the southern Cascade Range, and an undetermined area of the lava plateaus to the east was destroyed by ash flows emanating from that volcano or satellite vents. The vast clouds of steam and dust emanating from that volcano roughly coincided with the beginning of the great Ice Age, and the timing may have been more than merely coincident.

The present Lassen Peak volcano is small and of little geologic significance compared to that volcanic giant of 3 million years ago. The interval of its eruptions is poorly known because our historic record is very short. It is known on the basis of geologic evidence that eruptions over the past several thousand years have had relatively small local ecological or environmental impact. Man has changed this little: there are few human habitations in the region and no major highway

or railway arteries. Because the thermal energy of the volcano today is small compared to the geologic past, there seems little or no danger of a sudden, explosive eruption that might catch local tourists or residents unprepared. Scientific studies and instrumentation may soon be so extensive as to make a "surprise" eruption a virtual impossibility.

The eruption of lava flows from the west flank of the volcanic area in sufficient volume and of sufficient fluidity to reach the Sacramento River is a possibility, but little more than that. Detritus from such a flow could cause substantial sedimentation and related problems downstream, but eruptions of this type that have most recently occurred in the area (near Soap Butte, northeast of Red Bluff) were not of the explosive type and future ones offer little potential hazard to the lives of the local population. What's more, they are probably no more than a remote possibility. . . . Q. A.



The 1915 mudflow as seen on May 24, 1915. Photo by B. F. Loomis.

"As we continued to gaze at the wonderful spectacle, the glow commenced to increase in brilliancy, now brighter, now still brighter, until, behold, the whole rim of the crater facing us was marked by a bright-red fiery line which wavered for an instant and then, in a deep-red sheet, broke over the lowest part of the lip and was lost to sight for a moment, only to reappear again in the form of countless red globules of fire about 500 feet below the crater's lip. These globules, or balls of fire, were of varying size, the largest appeared at that distance (21 miles) about 3 feet in diameter, the smallest appeared as tiny red sparks. All maintained their brilliancy as they rolled down the mountainside until lost to sight behind the intervening range of hills.

"These phenomena took place at intervals of about 8 minutes for a period of some 2 hours, and to the writer it appeared as though he were looking at a titanic slag-pot being slowly filled by molten slag in some smelter. The glow over the rim gradually increased in intensity until the pot's rim was brilliantly marked by the appearance of slag itself. Finally, the slag spills over the lip in a vivid red sheet and, as it runs down upon and into the slag dump, it breaks through the crust of older slag and appears against the background as splashes of deep-red molten material.

"... We watched this re-occurring boiling-over, as it were, of the crater for a period of two hours, at the end of which the activity seemed to decrease. Concluding that the display for that evening was nearly at an end, we returned to the power house and made preparations for a trip on the morrow to Manzanita Lake, which lies almost at the foot of the mountain.

"Next day proved a disappointment, as the sky was overcast and the peak was shrouded in dense storm clouds. Nevertheless we started, and arrived at the lake about 10 in the morning. At brief intervals the clouds would break sufficiently to permit us to see the peak, which was steaming and smoking in great volumes, indicating that the activity had immensely increased. We also observed that there was on the western slope a dark mass of matter appearing almost black. This mass appeared about 1,000 feet across and extended down the slope for possibly a distance of 2,000 or 2,500 feet. From our location this mass appeared like vol-

canic mud and must have been of a consistency greater than ordinary mud, as the surface still maintained its roughed, furrowed appearance."

Without doubt, the Milford party had seen the overflow of lava that now forms the black tongue on the west side of the peak. The flow, a gray to black glossy dacite with white feldspar phenocrysts, has been the subject of much debate. Dr. Day, who saw it in the field and analyzed it in the laboratory, thought it too cool when emplaced (not over 850°C. was his estimate) and therefore, too viscous to have actually flowed. He envisioned the flow as actually a lifting up of the volcanic plug, its lower core exposed for a while in a red hot state through a large crack in the mountain side. The "slag-pot" effect he explained as the breaking off of colder, upper pieces to reveal, for a moment, the red hot core beneath.

Not all observers and not all geologists agreed with Dr. Day's reasoning. Mr. Milford's description does, indeed, sound as if he were describing a flow, and whether there was such a flow or not is crucial to explaining the events of the night of May 19 on the east side, where no one saw the "balls of fire", but where the volcano had, under cover of darkness, changed the landscape.

The vigilance of two dogs prevented the volcano's outbreak from turning into tragedy. They are the heroes of Lassen, for whatever it was that the mountain did that night on the eastern slope, it caused a great mudflow, which swept down Lost Creek with such momentum that it crossed the 100-foot high divide into Hat Creek, washing away ranch buildings, sweeping away timber, carrying 20-ton boulders for as much as 5 or 6 miles.

Four ranches were destroyed by the flood. One—prophetically, perhaps—was called "Lost Camp"; its buildings were removed, its land covered by debris. Fortunately the owner, A. J. Herbert, was not yet occupying it, as it was used primarily for summer grazing range.

The other three ranches must have been used for the same purpose, for there was no one at home at any of them when the once wide, flat meadows on which the cattle had grazed were covered with mud and rocks. Two of them, the Anklin and Jessen ranches, which lay north and east of Raker Peak

(Jessen Peak) on Lost Creek were covered with scrambled logs and boulders as large as 10 feet in diameter. On the Anklin ranch, even the site of the buildings was unidentifiable after the mudflow. Today, The Lassen Peak Highway runs through Anklin meadows; "Hot Rock" (Highway marker number 44), a block of dacite brought down in the great mudflow while still hot, lies in the meadow.

"Survivors Hill" also is near here, but the survivors referred to are arboreal survivors of the mudflow of May 19 and the *nuée ardente* of May 22.

There were, however, also human survivors of the mudflow farther down on Hat and Lost Creeks. Near Old Station, 20 miles from the peak, the Wid Hall family was homesteading. Above them a mile and a half, on Lost Creek, Elmer Sorahan had commenced homesteading; but at the time of the mudflow he was still living in a tent, with his dog.

Wid Hall told the story in these words:

"In the night [Elmer Sorahan's] dog barked, raved, and stuck his paws against him in the bed to wake him up. Elmer thought it might be some kind of animal, a bear or panther, so he got up and dressed, put on his high top boots and laced them up. He put his gun by the side of the bed, then peeped out to see what the dog was barking at.

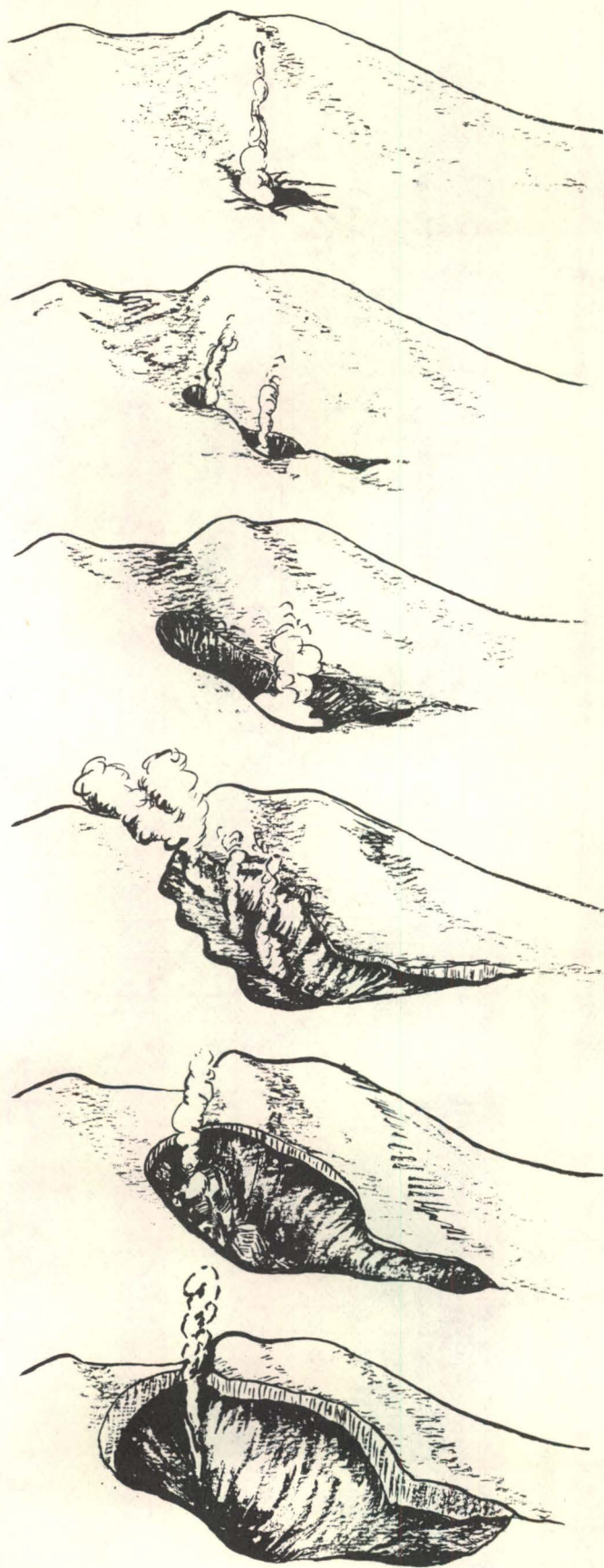
"He saw the mudflow coming like a wave about twelve feet high which looked like a white streak on top. The flood made a roar something like a gale of wind in the trees, with a crash and boom of the logs and rocks as they came tumbling along in the flood. He realized that it must a flood coming, so without waiting for his gun, he left everything and ran down the creek to awaken those who lived below him on the creek.

"It was about eleven or twelve o'clock when the flood reached our place. Elmer came with a rush, and he was perhaps five minutes ahead of the wave that struck our house. He gave a yell that startled us, and we all jumped up in a hurry. Frank Bartlett happened to be staying there that night, but he was sleeping in the barn across the creek, 150 yards distant. Elmer then ran across the creek to awaken him, and just got back across the creek when the bridge went out. Frank remained on the other side. In the meantime, Mrs. Hall telephoned to the people below on the creek that the flood was coming. The people on the lower Hat Creek were very much excited, but the flood did but very little damage below the Wilcox place, and it was near daylight when the flood reached the lower Hat Creek.

View of the explosion crater through 1914, showing its progressive enlargement. These drawings were made from photographs of the crater made by those who climbed the mountain, together with available measurements and descriptions. All photographs were projected by the artist so that there is the same point of view for all drawings.

No one climbed the mountain during the winter of 1914-15. The last ascent of the season on October 20, 1914, by photographer Benjamin Franklin Loomis; the next on March 23, 1915, by E. N. Hampton, who reported the explosion crater to be as large as the old crater bowl; nearly circular, and about 1000 feet in diameter.

The entire 1914 crater was filled with lava—the controversial black dacite—on May 19, 1915. Two smaller craters developed in 1915, and a larger one in a final burst of effort in 1917. All three are marked and visible in the crest of the peak today.







Part of the Devastated Area as it appeared following the *nueé ardente* of May 22, 1915. Photo by Model Studio, Anderson.

"As soon as Elmer returned he took the two [Hall] girls, one by each hand, and beat it for higher ground. The older girl, Marian, was fairly well dressed, but the younger one was too slow and had no shoes on, and in their haste she stubbed a toe nail off. The crash and roar of the flood was so intense that you could hardly hear one yell even at a short distance.

"After we went to the woods it began to rain, so we went to the high ground, and made our camp under a tree. I had just two stubs of matches in my pockets, and we managed to get a fire.

"About three o'clock we tried to get back to the house, which had moved 53 feet and lodged against a tree and the yard fence, but could not reach it at that time. We had some provisions in the house that were not affected by the flood, so we could eat. On leaving the house we left the door open and the flood entered about two and a half feet deep, then on the ebb flow part of the mud and water ran out, but when the mud had dried it was about sixteen inches deep in the house. A green log also had floated in, a rough old thing, which was about all four of us could do to get it out of the house. The mud flow looked more like mortar than

"Hot Rock"—one of the many hot fragments that was spewed out by the volcano in 1915. This one measured 20x18x14 feet. Photo by B. F. Loomis.



Lost Creek, following the flood of 1915. Professor Diller is barely visible in the center of the picture. Photo by B. F. Loomis, Model Studio.



water, and where it ran over the ground it left it slick and smooth like a pavement.

"When daylight arrived, five of the neighbors from below came to our assistance with horses, but the trails were so bad and rough, that we declined to go away. But during the day we put in a temporary bridge across the creek so we could get to the barn where the horses were, so if anything serious should happen we could get away. Water had run through the barn, but not enough to take it away. On their way over, the younger girl, Evelyn, saw a small pond of muddy water and asked if she could wade through it. And when she did so, found that the water was warm, something more than 'milk' warm, and that was in the afternoon of May 20th."

Harvey Wilcox was another homesteader who lived somewhat lower than Mr. Hall, but on Hat Creek. Perhaps he had no telephone, for his warning came not from Mrs. Hall, but, like Mr. Sorahan's, from his dog. He barely had time to grab his overalls and run, leaving behind him his house and all its contents, which were lost. He himself was barefoot. To get to his nearest neighbors, the Halls, on Lost Creek, he had to cut across a lava terrain known now as "The Devil's Half Acre" (south of Subway Cave), which cut his feet so badly that he was crawling on his blistered hands and knees when he arrived—at 9 o'clock the next morning.

Word of the catastrophe came to Viola the next evening—Friday, May 21. The greatest rubbernecker of them all, photographer B. F. Loomis, left early the next morning to see the damage. He arrived at Lost Creek about noon, examined the whole scene of devastation, photographed it and the mountain (which was erupting mildly about every fifteen minutes) carefully, and made his way homeward. By 4 o'clock he had reached Manzanita Chute (west of Manzanita Lake), where he had an incomparable view of the mountain, only 6 miles distant.

Then, the mountain blew its top. The largest of all eruptions commenced, throwing out hot mud, hot rocks and pumice for miles, and sending ash into Nevada. At its height, the column of "smoke" reached 25,000 feet above the summit of the mountains, as measured by the rangers' triangulation.

A photograph of this, the noted "mushroom cloud"—precursor of the atomic blast—is the most famous of all the photographs taken of Lassen's eruptions. But it was not taken

by Loomis, but by R. I. Myers, from Anderson. Mr. Loomis wrote bitterly that Mr. Myers was not very well equipped for taking cloud pictures at a distance of 50 miles and "his pictures are not very clear." Mr. Loomis himself had run out of film.*

When he, too, heard about the great mudflow, Professor Holway hurried from Berkeley to Lassen, but the snow was so deep on the mountainside that it was not until May 27 that he was able to climb to the top. There, he could easily see that there had been a blast, and concluded that the blast had somehow caused the mudflow.

The throat of the volcano, he reasoned, must have been choked by debris, forming a lid. The pressure within the volcano, building up, forced its way out beneath the lid, producing a downward blast that carried with it hot ashes and rock that melted the snow on the mountain slopes, causing a slide that became the great mudflow. That the trees were felled by the blast rather than broken by the flood was attested by their alignment—all pointing the same direction. The needles of those that still stood upright on the borders were seared by the hot blast.

The possibility of a lava flow he dismissed in these words: "Large quantities of real lava which in a former period cooled and became solid down in the throat of the volcano have been ejected, but there is no evidence that molten lava has flowed from the volcano during the present period of activity. [Nevertheless], reports of luminous rock are too reliable to be discarded. . . . Professor Diller found rocks that seem to have been recently fused . . . [therefore], molten lava, whether actually ejected or not, has been nearer the surface than usual."

It was not for more than a month that anyone recognized that the day of the mushroom cloud had also been the day of the *nueé ardente*. Since most of the winter snow had been melted by the summer sun or had been melted in the mudflow of May 19–20, the flooding of the 22d was not as great as the flooding two days before; in addition, most ranchers who might have been in the area to observe the phenomenon had already been driven out by the mudflow, or had not yet arrived for the summer—fortunately; had it been otherwise, the phenomenon would have changed to tragedy.

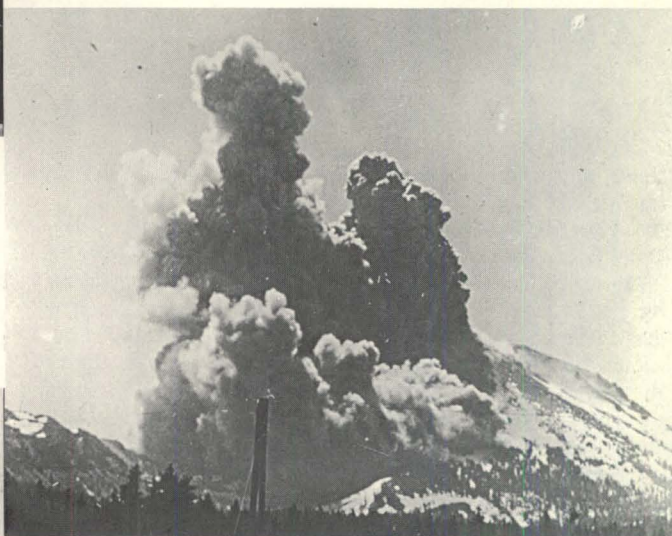
* Actually, glass plates.



FOUR SUCCESSIVE VIEWS

of Lassen erupting on

June 14, 1914



All photos by B. F. Loomis

It was that intrepid photographer, B. F. Loomis, who discovered that something momentous had occurred on the east face of the peak after the great mudflow of the 19th. He had been told by the men of his mill that a considerable amount of timber had been blown down, but exactly what this meant, he did not know. So when Mr. Diller arrived again in July of 1915 to view the effects of the mudflow, he and Mr. Loomis proceeded at once to what is now known as the Devastated Area. Mr. Loomis was quite surprised:

"Could I believe my eyes? I had intended to tell Mr. Diller how the trees were battered up in the mudflow of May 19th, but when we reached the head of Lost Creek we found the trees all blown down. In the second great eruption of May 22nd, a hot blast of steam had shot down across the heads of Lost and Hat Creeks and had blown down all the timber for a space about a mile and a quarter wide, and away down across the head of Hat Creek.

"The trees, although they were all lying down, showed on their upper side where the mud flow of the 19th had battered the bark all off, and the wood scarred, as they were before the second blast. I called Mr. Diller's attention to the fact that no trees had been blown down in the first mud flow, which was all mud flow, and no evidence of a horizontal blast. But it seems that the first big eruption formed a lid over the top of the mountain, and as it had torn a great gash on the east side, the hot steam shot out as a horizontal blast and had blown down all this belt of timber. In one place, near the top of the cliffs to the east of Lost Creek, a small fire had been set, presumably by the blast, in which, perhaps, a hot rock had been thrown over there, but it was early in the season and the fire did not run more than a few yards when it went out.

"The first sight to greet our eyes after reaching the flat above the Cold spring, was that the trees to the left on the steep hillside were all thrown over against the side of the mountain. They all pointed in one direction, up the hill. . . .

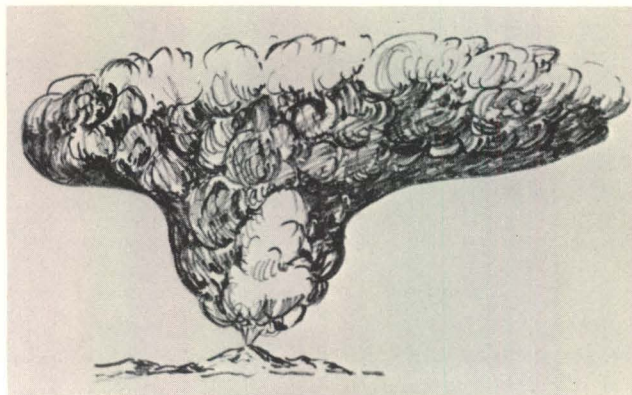
"Then all those trees on the divide between Lost and Hat Creeks were all blown over. One of these large trees, nearly four feet in diameter, in the centre of the blast was broken off about eight feet above the ground, and the tree was carried about sixty five feet from the stump. Something more than hurricane force obtained here. . . .

"It was estimated by the Forest Service that between four and a half to five million feet of timber was destroyed by the mud flow and the hot steam blast."

Mr. Diller, like Professor Holway, accepted the "volcanic lid" theory, although he considered the lid to be composed of new rock, not debris. He envisioned the events of May as being the time of extrusion of new lava, which finally spilled through a notch on the west slope (as actually seen by the Milford party) and is still plainly visible from Manzanita Lake as a dark streak on the mountain top. The lava formed a lid, Diller concluded, building up pressure that culminated in two blasts, one on the 19th, which caused the great mudflow, and one on the 22d, which felled the trees.

The day after Diller and Loomis had visited the Devastated Area, Dr. Day arrived. He made one trip to the mountain with Diller, and another with Diller and Loomis, and subsequently spent a good deal of time by himself reconnoitering the volcano.

His conclusions were that there were two blasts, in agreement with Diller; but he thought that the lava that formed the lid was never fluid enough to flow. Rather, the "new



The mushroom cloud.

lava" represented the old plug, lifted more than 300 feet. What appeared to observers to be molten lava (the "slag-pot") was the cracking open of the mountain during swelling, permitting a view of the red hot core.

Water for the mudflow he thought derived from the melting of snow by hot ashes, hot rain (from steam), and the hot blast itself.

To this idea, Mr. Loomis took vigorous exception. He did not think it was a hot blast, but actually hot water that came out of the volcano on the 19th—"a million barrels of it." He accepted the idea of two blasts, but the first he considered to have gone into the air, not downward. "All the destroyed timber in the first great flood [May 19] was carried away by the mud flow, and positively nothing else. . . . An immense amount of hot water, steam, and hot rocks were thrown out on the east side, and this mass ran down the mountain side, taking everything before. . . . It seems to me that he [Diller] and all the rest of the scientists have overlooked [the fact that the trees were standing on May 22, before the blast], or else have disregarded our testimony."

Perhaps so. At any rate, by the middle of the twenties, it was generally agreed that Lassen had been in eruption, and that, following the great blasts of late May, 1915, had slowed gradually into a slow steamer, as she is now; that there had been a great mudflow on the night of May 19; and that there had been a *mucé ardente* which produced the Devastated Area. The cause of the great mudflow, whether there had been one or more blasts, whether or not there had been a fluid lava flow, were still points of argument. No one, except Loomis, seriously considered that vast quantities of water came out of the volcano, but all thought that the heavy winter snows had acted as triggers to the eruption as well as furnishing fluid for the mudflow.

In 1926, R. H. Finch arrived at Mineral to take charge of the Lassen Observatory, a branch of the Hawaiian Volcano Observatory, built and staffed by the U. S. Geological Survey. Besides manning the seismograph station, he found time to study numerous volcanological problems in the Lassen area.

By 1930, he was ready to publish a new explanation of the puzzles of May 19 and 22, 1915. He agreed with Loomis that the photographic and field evidence (the trees) did not indicate that there had been a hot blast on May 19. A small flood did accompany the emplacement of the lava over the western lip, but nothing indicated an explosion on the north-east, where the great mudflow ran. Although he, too, could



Lassen on June 11, 1915, after the last great eruption. Photo by B. F. Loomis.

not believe that vast quantities of hot water or mud actually came out of the volcano, he did agree that there was no lateral explosion; and, based on his experience with other volcanoes, he was certain that if there had been a vertical explosion, the following rainy fallout would not have been hot enough or great enough to melt very much snow.

"A few feet of snow," he wrote, "can absorb several inches of rainfall so that the rain produces but little immediate run-off. A hot blast, unless long continued, or a slight deposit of volcanic ash, would produce much the same effect as a rain—a melting of superficial layers of snow."

To melt the snow, as seemed to be required in order to account for the mudflow, he postulated an eastern lava flow as well as a western one. He suggested that it ran out of the eastern notch, under the snow banks, melting them almost instantly. Much of the lava was carried down with the flood, and the rest of it was blasted off the mountaintop by the *nueé ardente* of the 22d.

No one, of course, saw the lava flow, and there is none left in place on the mountain now.

In the summer of 1927, Howel Williams, then a graduate student at the University of California (now Professor Emeritus of the same institution), spent three weeks studying the petrography of Chaos Crags and Jumbles. He became intrigued by the Lassen area, and realizing that Mr. Diller's death in 1928 had cut short his intention of remapping the region as a companion to the Day and Allen hot springs study, he undertook to investigate the geology of the park.

Mr. Finch's explanation of the events of the 19th and 22d he accepted as the most reasonable, adding that although the superficial parts of the flow might not be hot enough, as Dr. Day had reasoned, to flow, the interior must have been hotter, as there was no way for the western lava flow to reach its present position except by flowing. Insofar as the eastern, hypothetical flow was concerned, Dr. MacDonald saw enough new dacite scattered about the eastern slopes of the mountain along Hat and Lost Creeks to make a very large dome, were it replaced to the top of the peak. Since no one saw such a dome, it may well have been a flow.

Recent workers have accepted this general picture: a lava flow over the western notch on the night of the 19th, as seen by the Milford party; a mudflow coursing down Hat and Lost Creeks on the east side, that same night, most likely caused by an undersnow lava flow; a *nueé ardente* on

the 22d, leveling and searing the trees on the Devastated Area, and removing the lava flow of two days before.

Carbon samples from charred logs in flows on Manzanita Creek have given ages of less than 200 years by radioactive analysis; in addition, other dacite flows in the area show evidence that the *nueé ardente* is reasonably common in Lassen eruptions.

As for the role of water in these eruptions, all workers agreed that there was some connection between the heavy precipitation and the volcanic outbursts, but only Mr. Loomis believed that the water was the outbursts. Others—Diller, Holway, Day, Finch, and Williams—considered that it somehow triggered them. Dr. Day's explanation was rather complex: The formation of crystals in the magma that was the volcanic source released water to the remaining magmatic liquid; this increased the pressure of the magma on its container. This pressure, added to by the heating of water derived from melting snow, became too great for the mountain to bear, resulting in a pressure-relieving outburst. The periodicity of the outbursts is thus explained by the alternating release and buildup of vapor pressure.

Gordon A. MacDonald, who has, in this past decade, remapped the geology of much of the park on a larger scale, offers this explanation of the role of water:

"Probably, early in 1914, magma already was approaching the surface and causing a swelling and cracking of the old Lassen dome. This, in turn, allowed melt water from the thick snow accumulation in the crater to penetrate down into the hotter regions within the dome (perhaps even coming into contact with the rising new magma itself) where it was transformed into steam and produced the phreatic explosions of 1914 and 1915. Further cracking and blasting out of the crater by the steam explosions opened a pathway to the surface and led to the eruption in May, 1915. . ."

Certainly, this is not the last word on Lassen, but it is among the latest. In 1916, Professor Holway told the Commonwealth Club "hope for continued activity is not yet lost." Geologists will hope he was right.

FURTHER READING

- Day, Arthur L., and Allen, E. T. 1925. The volcanic activity and hot springs of Lassen Peak. Carnegie Institution of Washington Publication 360, 190 pp., 81 figs., 13 plates.
- Diller, J. S. 1886. Geology of the Lassen Peak district. U.S. Geological Survey 8th Annual Report, Part 1, pp. 395-432.
- Diller, J. S. 1895. Description of the Lassen Peak sheet (California). U.S. Geological Survey Geological Atlas no. 15.
- Finch, M. H., and others. The Volcano Letter, various issues from 1925 through 1930.
- Hodge, William C. 1915. The lookout on Mt. Lassen. Sierra Club Bulletin, vol. 9, no. 4, pp. 298-304.
- Holway, R. S. 1914. Preliminary report on the recent volcanic activity of Lassen Peak. University of California Publications in Geography, vol. 1, no. 7, pp. 307-330.
- Loomis, B. F. 1926. Pictorial history of Lassen Volcano. Revised by Paul E. Schulz, 1947. Loomis Museum Association, Mineral, California, 4th Printing 1962. 108 pp.
- Macdonald, Gordon A. 1963. Geology of the Manzanita Lake quadrangle, Shasta County, California. U.S. Geological Survey Geologic Quadrangle map 248.
- Macdonald, Gordon A., and Katsura, Takashi. 1965. Eruption of Lassen Peak, California, in 1915: example of mixed magmas. Geological Society of America Bulletin, vol. 76, pp. 475-482.
- Williams, Howel. 1932. Geology of the Lassen Volcanic National Park, California. University of California Publications in Geological Sciences, vol. 21, no. 8, pp. 195-386.

MINERAL INFORMATION SERVICE

A PUBLICATION OF THE CALIFORNIA DIVISION OF MINES AND GEOLOGY

Volume 23 Number 11
November 1970



MINERAL INFORMATION SERVICE

Volume 23 Number 11
November 1970

State of California
The Resources Agency

Ronald Reagan, Governor
Norman B. Livermore, Jr.,
Secretary

Department of Conservation
Division of Mines and Geology

James G. Stearns, Director
Wesley G. Bruer, Chief

Division Headquarters: 1416 9th Street, Room 1341, Sacramento 95814

District Offices:

Los Angeles: Los Angeles State Office Building, Room 1065,
107 South Broadway, 90012

San Francisco: Ferry Building, San Francisco 94111

Sacramento: 1416 9th Street, Room 118, Sacramento 95814

MINERAL INFORMATION SERVICE is designed to report on the progress of earth science in California, and to inform the public of discoveries in geology and allied earth sciences of interest and concern to their lives and livelihood. It also serves as a news release on mineral discoveries, mining operations, statistics of the minerals industry, and new publications. It is issued monthly by the California Division of Mines and Geology. Subscription price, January through December, is \$2.00.

Publications of the Division also include the Annual Report of the State Geologist; the Bulletin, Special Report, Map Sheet, and County Report series; the Geologic Map of California; the Bouguer Gravity Map of California; and other maps and publications. A list of the Division's available publications will be sent upon request. All mail for the Division of Mines and Geology, including orders for publications, changes of address, and subscriptions to *Mineral Information Service*, should be addressed to the Sacramento headquarters office.

MARY R. HILL, Editor

Second-class postage paid at Sacramento,
California. Return postage guaranteed.

A LETTER TO THE EDITOR

Woodland, California
June 22, 1970

Dear Editor . . .

Recalling some incidents [regarding the Lassen eruption of 1914-15]: In 1927 of September, two of us from the P. G. and E., George Duncan and myself, decided on a weekend trip to climb Mt. Lassen due largely to some kidding by our lineman.

We drove to Viola, stopping at B. F. Loomis' hotel for directions. He was very cooperative until he found out that we worked for the P. G. and E. Thinking that his troubles with his D.C. generating outfit had a priority, he took us out to the power plant. An electrician from Chico worked for a week on it without getting anywhere and went home.

I had just undercut the commutator on my Dodge 23 generator and noticed that his commutator needed the same treatment. Well, to make it short, we got one generator working to his delight. From then on nothing was too good for us at the hotel where he entertained with incidents that had happened at the Mt. Lassen eruption. Many of his photographs showing different stages of eruption were exhibited on the hotel walls of the living room, some being touched up in color by his artistic wife.

The Lance Graham incident, as I recall it follows. The five of them were standing close to the crater when it blew out. Graham was knocked out and slid down in the debris some 50 feet or so, lodging on a rock. The rest of the party took off down the mountain, as it was shaking plenty by then.

Finally the shaking slowed down and some one remembered seeing Graham down in the crater, so they decided to go back and haul him out, first carrying, then dragging, and finally leaving him on the mountain, as the shaking became frightening! Graham was still unconscious when B. F. Loomis and a packer went back and picked him up. Mr. Loomis says, "I never saw a man so torn up as Graham was and live."

Several people in Woodland that had lived in Manton and knew Graham, agreed with the story. Graham was still living in Manton around 1930. Some early mountaineers were pretty rugged.

Very truly yours,
W. F. Loughboro

P.S. We climbed Mt. Lassen from the steep west side getting a little snow and rain on the way up. There were steaming vents on top, a little pond of water on the southwest side of the crater with some floating rocks. We skied down on hard snow with our hobnailed boots most of the way, which was some relief from the hike up.—W.F.L.

STATEMENT OF OWNERSHIP MANAGEMENT AND CIRCULATION (Act of October 3, 1917; Section 4105, Title 49, United States Code)		Page 1
1. Name of publication	MINERAL INFORMATION SERVICE	
2. Issue date	September 24/70	
3. Frequency of issue	MONTHLY	
4. Location of main office of publication (Street, city, county, state, ZIP code)	Resources Building, 1416 Ninth Street, Room 1341, Sacramento, California 95814	
5. Location of the headquarters or general business office of the publisher (See previous)	Resources Building, 1416 Ninth Street, Room 1341, Sacramento, California 95814	
6. Names and addresses of publisher, editor, and managing editor	Publisher: California Division of Mines and Geology Resources Building, 1416 Ninth Street, Room 1341, Sacramento, California 95814 Editor: Mary R. Hill Resources Building, 1416 Ninth Street, Room 1341, Sacramento, California 95814 Managing Editor: Mary R. Hill Resources Building, 1416 Ninth Street, Room 1341, Sacramento, California 95814	
7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.)	State of California Sacramento, California	
8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state)	NONE	
9. For completion by nonprofit organizations authorized to mail at special rates (Section 132.122, Postal Manual): (Check one) The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes: (If checked, publisher must give date and address of each change of status since last statement.)	(Check one) ☐ None changed during preceding 12 months ☐ None changed during preceding 12 months ☐ (If changed, publisher must give date and address of each change since last statement.)	
10. EXTENT AND NATURE OF CIRCULATION a. Total no. copies printed (Net Press Run)	22,000	22,000
b. Paid circulation 1. Sales through dealers and carriers, street vendors and counter sales	12,000	14,044
2. Mail subscriptions	12,000	14,044
c. Total paid circulation	13,091	14,044
d. Free distribution (including samples, by mail, carrier or other means)	1,250	1,241
e. Total distribution (Sum of c. and d.)	14,341	15,285
f. Office use, left-overs, unaccounted for, spoiled after mailing	8,459	6,715
g. Total (Sum of e. and f.)—Should equal net press run shown in 10a.	22,000	22,000
I certify that the statements made by me above are correct and complete. <i>Signature of Editor, Publisher, Business Manager or Owner</i>		

OUR COVER

Air view of Mt. Lassen in 1963. Photo by Rogers Air Service.

THIS ISSUE

Copy for this issue was prepared in camera-ready form by
Richard R. Moar and Richard Boylan.