Price 10¢

BUMPASS HELL NATURE TRAIL

Lassen Volcanic National Park

Your contributions make these leaflets possible. If you plan to keep this one, please leave 10¢ in the box.

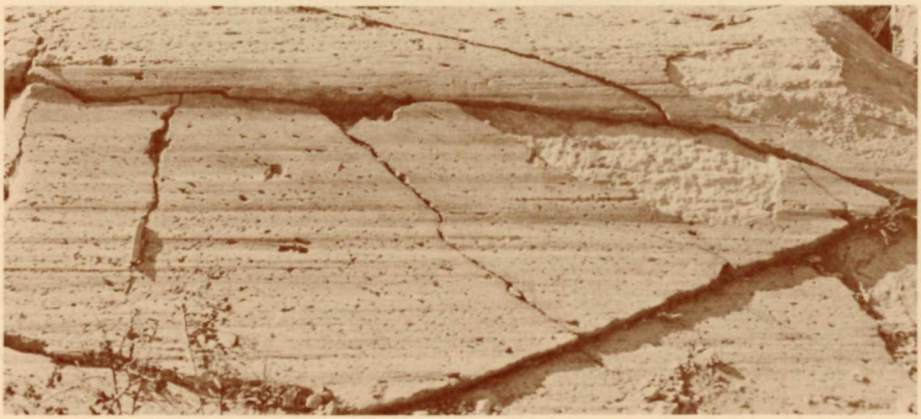
Passing along the edge of the ancient volcano, Mt. Tehama, this trail takes you to the park's most active thermal area. It reveals some of the dramatic forces that have shaped this landscape and shows that a dynamic interplay of forces still persists.

The round trip is a little less than 3 miles and takes about 3 hours for a leisurely walk. Stakes along the trail correspond to the numbered paragraphs in this folder which point out features of special interest.

CAUTION: Stay on the trail at all times while you are walking through thermal areas. A thin crust, too weak to support your weight, often forms around the edges of boiling hot pools and mudpots.

LASSEN PEAK

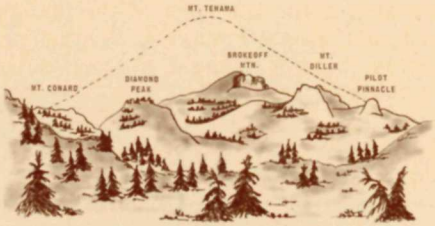
1 About eleven thousand years ago, Lassen Peak shoved its way through the side of Mt. Tehama. The world's largest plug dome volcano probably rose to its full height in five short years. Imagine the enormous quakes that shook this ground!



GLACIAL STRIATIONS

2 Glaciers, tremendous bodies of ice hundreds of feet thick, passed this way, gouging, scratching and polishing these solid lavas. Watch for more of their evidence ahead.

3 Mt. Conard, Brokeoff Mountain, Mt. Diller, Pilot Pinnacle, and the ground upon which you stand are remains of the once mighty Mt. Tehama, a composite volcano similar to Mt. Shasta.



MT. TEHAMA AND PRESENT TOPOGRAPHY

A million years in the building, Tehama was then largely destroyed, perhaps in a few thousands of years. First volcanic activity weakened the areas on each side of Diamond Peak, then streams and glaciers carved them out to form valleys.

4 You know you are high in the mountains when you see a whitebark pine tree. Only a few specimens live here at 8,200' but whitebark pine is the only tree that can survive the harsh wind and snow conditions that prevail 1,000' higher on Lassen Peak. These high elevation habitats are the result of volcanic mountain building.

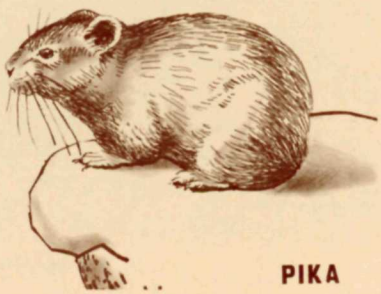
5 Recent glacial activity dimpled Lassen's steep slopes and help us date the peak. Older than Lassen, 110-feet-deep Lake Helen was scooped out by the same enormous glaciers that modified Mt. Tehama.

GLACIAL ERRATIC

6 The boulder sitting across the canyon just to the left of the parking area demonstrates the power of a glacier. This "glacial erratic" was carried along in the ice flow and left perched on the ridge when the ice melted.

7 Volcanic landscapes contain steep terrain and porous rocks. Water does not stay on the surface because it either drains off or seeps quickly into the ground to reappear elsewhere as a spring. East Sulphur Creek originates at the bottom of the canyon as seepage from Lake Helen and surrounding areas.

8 As lava cools and contracts, it forms a system of parallel cracks, known as jointing. Water then seeps into these cracks, freezes, and wedges blocks of rock loose to tumble and form talus slopes. These barren slopes look forbidding to us, but to the pika (or cony) they make an ideal home. Listen for the harsh, high-pitched call of these strange-looking small relatives of the rabbit.



PIKA

SILVERLEAF LUPINE

9 Notice especially on the slopes below you how silverleaf lupine has adjusted to living on high mountain slopes. Silvery hairs on the leaves reflect the intense ultraviolet radiation of this thin atmosphere. They also help maintain stable temperature and moisture conditions around the leaf by trapping a layer of air.

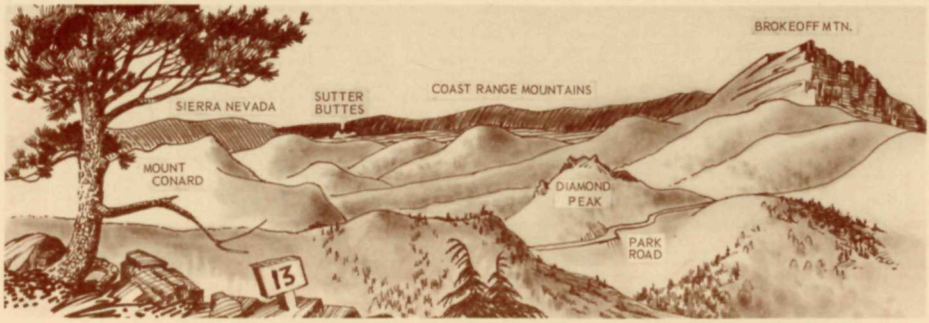
Pikas collect lupines and dry them in "haystacks" before storing them deep in the loose rocks for winter food.

10 Mountain hemlock is the predominant tree of this area. Short waxy needles and a spreading root system help it to grow on these dry slopes. Notice how the trees tend to grow in clumps in order to survive the struggle against powerful winter winds and deep snow.

MOUNTAIN HEMLOCK

11 As is common among plants that grow in this fierce environment, pinemat manzanita hugs the ground. Its vertical waxy leaves help conserve water. Its berries and seeds provide important food for birds and mammals who live here.

12 Lightning left a calling card here. Lightning storms are frequent near timberline, but because vegetation is sparse, fires do not normally spread far.



PANORAMIC VIEW FROM STAKE 13

13 All of the mountains in the Cascade Range, including Lassen Peak and Mt. Tehama, are volcanoes. However, the Sierra Nevada and the Coast Range visible in the distance were formed by different processes. Starting 10 miles south of here, the Sierra Nevada are primarily masses of granite that have been uplifted and tilted. The coastal mountains were largely formed by a squeezing process that folded, buckled, and uplifted them.

14 Spring comes late and winter early in the high mountains as is evidenced by the very thin growth rings on the trunk of this 400-year-old cut tree.

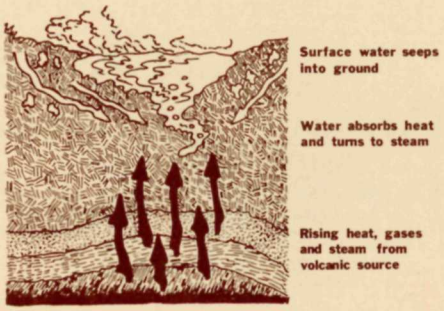
15 Bumpass Hell testifies to the existence of a residual mass of cooling lava perhaps 3 miles or so deep in the earth's crust. Bumpass Hell is not one of Mt. Tehama's main vents, but lies on the slope outside the caldera of the former volcano. It just happens that one of the many fissures or faults that riddle the region between the Sierra Nevada and the coastal mountains northwest of us penetrates deep enough here to tap volcanic heat.

Bumpass Hell was named by Kendall Vanhook Bumpass who discovered it and lost a leg as a result of burns suffered when he stepped in a thermal pool. Some temperatures reach 240° F. so avoid making it your Hell and stay on the trail!

16 Three types of lava are visible here. That which forms the rugged wall on the other side of Bumpass Hell is dacite, the same material that comprises Lassen Peak. Stiff and pasty when molten, it tends to be shoved up as spines rather than spreading out in a lava flow.

In the distance stands Mt. Harkness, a shield volcano with a small cinder cone on top. It assumed the shape of a giant Roman shield because its basalt lavas were highly fluid when molten.

Mt. Tehama, including Bumpass Hell and the ground upon which you stand, consists of andesite which is intermediate between dacite and basalt in characteristics. The sequence of flows from magma chambers over vast periods of time is commonly from basalt to andesite and then dacite.



CROSS SECTION SHOWING RELATIONSHIP OF SURFACE THERMAL FEATURES TO MAGMA CHAMBER

17 Volcanic rock gives off water when heated. The magma chamber under you is giving off hot steam and volcanic fumes including hydrogen sulfide which is the source of the rotten-egg smell. Surface waters percolate down through cracks in the earth's crust until they come into contact with the hot steam rising from the magma chamber or with hot rock above the magma. Then they return to the surface again as steam. Indeed most of the steam coming from Bumpass Hell originates as surface water. **A short spur trail leads to an interesting boiling spring.**

18 Violent, roaring, hot steam spewing from the "Steam Engine" aptly demonstrates why Bumpass Hell is called a hydrothermal area (water – heat). Water boils at 198° F. at this elevation rather than the 212° F. normal at sea level. However, this stream can be superheated by several additional degrees because it was heated under pressure.

PINK HEATHER **BOG KALMIA**

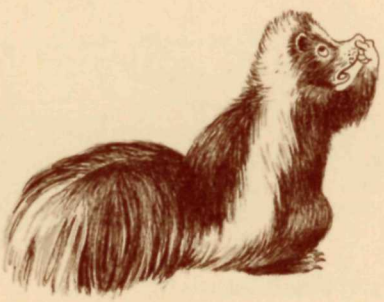
19 Although colorful, Bumpass Hell is a barren place. High temperatures combine with high concentrations of sulphur compounds and other factors to create an environment that is inhospitable to plants and animals. The difference in the abilities of living forms to tolerate these conditions is clearly illustrated by bog kalmia, pink heather, and rushes. Notice how bog kalmia and the grass-like rushes creep down this slope while pink heather is almost entirely restricted to the bank on the other side of the trail.

20 Andesite lavas decompose readily, but sulfuric acid and hot steam have greatly speeded up the process to carve out this 16-acre bowl. Surface streams feeding Bumpass Hell influence both the amount of steam produced and the strength of the acid.

21 Change is constant in Bumpass Hell and many features now differ from the way they were when K. V. Bumpass first viewed them over 100 years ago. Some of the changes have been sudden while most are the result of slower but persistent processes.

22 A vast reservoir of steam, probably several miles in area, feeds these dry vents or fumaroles and Bumpass Hell's other thermal features. Perhaps Bumpass Hell, Boiling Springs Lake, Devil's Kitchen and Sulphur Works all tap the same giant reservoir.

SULFUR SAM says DON'T BE A STINKER. Rangers deal firmly with those who take samples or disturb natural features.



23 The presence of sufficient water dilutes sulfuric acid and the decomposition of the lavas is incomplete. Clays such as those percolating in this muddy pool are then formed.

24 You would never recognize the whitish material in this mound as a non-precious form of opal which results from the complete decomposition of the lava in the absence of plentiful water.

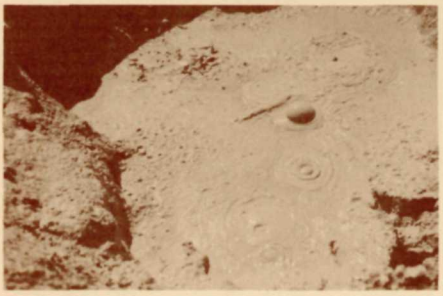
25 This former pool is an example of the continual changes in an active thermal area. While this pool has dried up, others in Bumpass Hell have enlarged and new ones have formed.

26 East Pyrite Pool boils violently in spite of the cool stream flowing into it. The black scum and bubbles on the surface contain tiny crystals of iron pyrite or "fools gold," an iron compound which is a product of chemical reactions in thermal waters. When in large pieces fools gold has the gold color and metallic luster from whence it gained its name. Other iron compounds cause the red, yellow and tan colorations in Bumpass Hell.

Lean against the large boulder to the left. The vibrations you feel are probably caused by steam pressure underground.

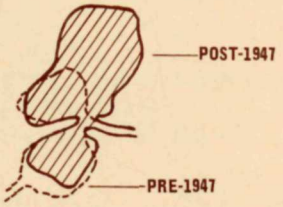
NOTE: Trail ends here. Do not go beyond this point because the thin crust will not support your weight. Serious injuries can occur should you come in contact with the steam and boiling water under the fragile surface.

To see additional thermal features retrace your steps and take the path to your right. This will take you through the central portion of the Bumpass Hell Thermal Area marked by numbered stakes #27 – 31.



27 Mudpots are an intermediate type of thermal feature between hot springs with a plentiful supply of water, and fumaroles which are dry. The force of the steam here is strong enough to splash hot mud and build up a rim creating a "mud volcano."

28 In 1947 West Pyrite Pool was enlarged by 800 feet when a large portion of the surrounding crust collapsed to create the largest sudden change in topography in Bumpass Hell that has ever been recorded.

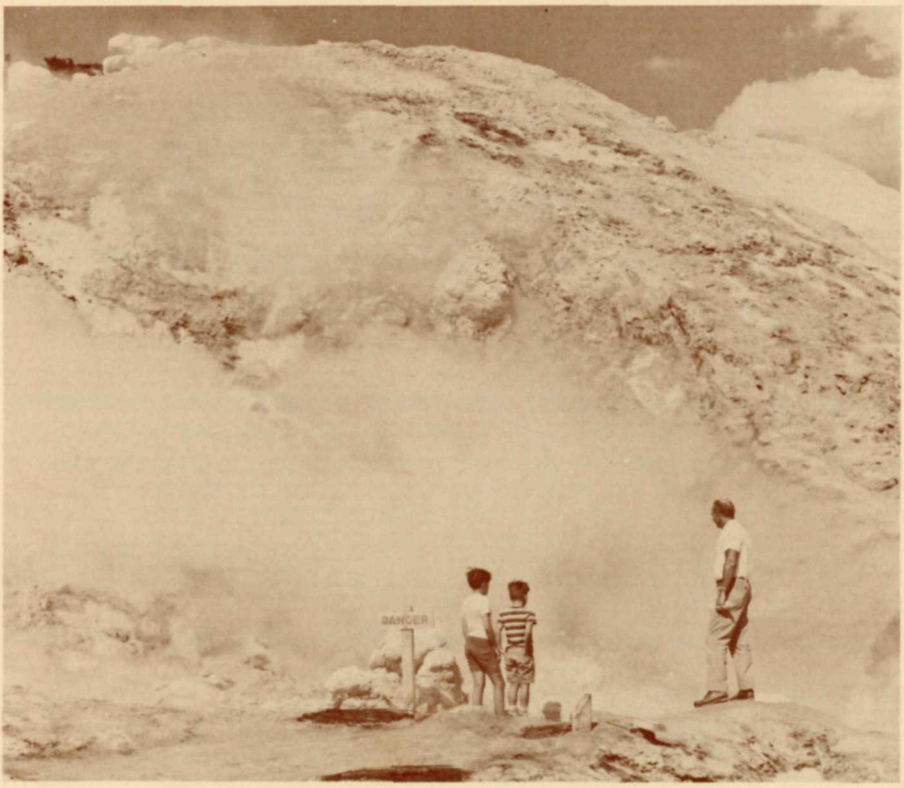


WEST PYRITE POOL

29 Acid, steam, rain and frost will continue to attack these rounded boulders until they too are reduced to a powder or clay.

30 Yellow sulphur crystals often form on surfaces covered by thin sheets of thermal waters or where hydrogen sulfide hisses from holes in the ground.

31 Tremendous amounts of energy are released in dramatic form by the "Big Boiler." The flow of energy in nature is continuous, and everything in nature, living or not, is tied to it. As you retrace your steps, reconsider the dramas portrayed along the trail in terms of energy flow.



This is the end of the trail and last numbered feature of the Bumpass Hell Nature Trail. You should now return to the trail junction and proceed to the right to rejoin the main trail.

We hope that this leaflet has helped to make your walk more enjoyable. Please return this leaflet to the leaflet box or put 10¢ in the box if you wish to buy the pamphlet.

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1972 REVISION

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