PRICE 30¢

YOU WILL BE EXPLORING A MAJOR HYDROTHERMAL AREA CONTAINING BOILING WATERS AND HOT STEAM. LEAVING THE MAINTAINED TRAIL AND BOARDWALKS IN THE THERMAL BASIN WILL EXPOSE YOU TO SERIOUS HAZARDS. SERIOUS BURNS CAN RESULT. PLEASE STAY ON THE MAINTAINED TRAIL SYSTEM.

BUMPASS HELL NATURE TRAIL

Lassen Volcanic National Park

Your contributions make these leaflets possible. If you plan to keep this one, please leave 30¢ in the box.

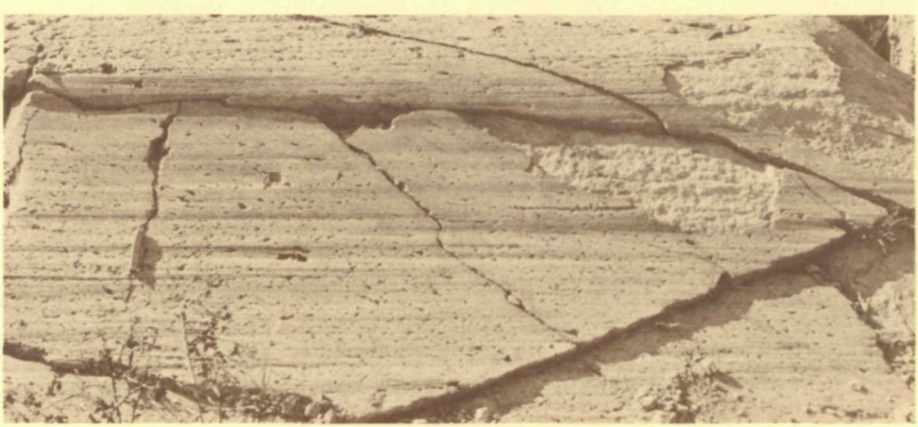
Passing along the edge of the ancient volcano, Mt. Tehama, this trail takes you to the park's most active thermal area. Here dramatic forces have shaped the landscape and shows that a dynamic interplay of forces still persists.

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.

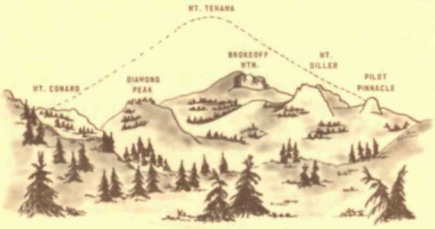
LASSEN PEAK

1 About eleven thousand years ago, Lassen Peak erupted through a vent on the flank of Mt. Tehama. Possibly the world's largest volcanic dome, Lassen Peak may have reached its full height in only five years.



GLACIAL STRIATIONS

2 Glaciers are tremendous bodies of ice that are hundreds of feet thick. They passed this way, gouging, scratching and polishing the solid lava. There is more evidence of this ahead.



MT. TEHAMA AND PRESENT TOPOGRAPHY

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.

The Tehama Volcano was active for approximately one million years. As activity declined at Tehama, streams and glaciers carried away the weak volcanic rocks and created the valleys in this area.

4 Whitebark pine is one of a few specimens that live here at 8,200'. It is the only tree that can survive the harsh wind and snow conditions that prevail on Lassen Peak. These high elevation habitats are produced by volcanic mountain building.

5 Recent glacial activity gouged depressions on Lassen's steep slopes. These depressions aid in dating the peak. One hundred and ten feet deep, Lake Helen was scooped out by the enormous glaciers that modified Mt. Tehama. It is older than Lassen Peak itself.

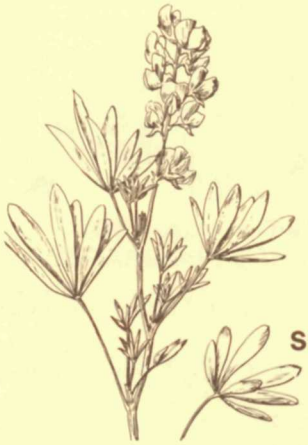
GLACIAL ERRATIC

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 have steep terrain and contain porous rocks. Water does not stay on the surface because it either drains off or seeps quickly into the ground and reappears elsewhere as springs. 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 that fall away and form talus slopes. These barren slopes look forbidding to us, but to the pika (or cony) they are an ideal home. Listen for the harsh, high-pitched call of these strange-looking smaller relatives of the rabbit.

PIKA



SILVERLEAF LUPINE

9 On the slopes below you can see how the silverleaf lupine has adjusted to living in a mountain environment. 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.

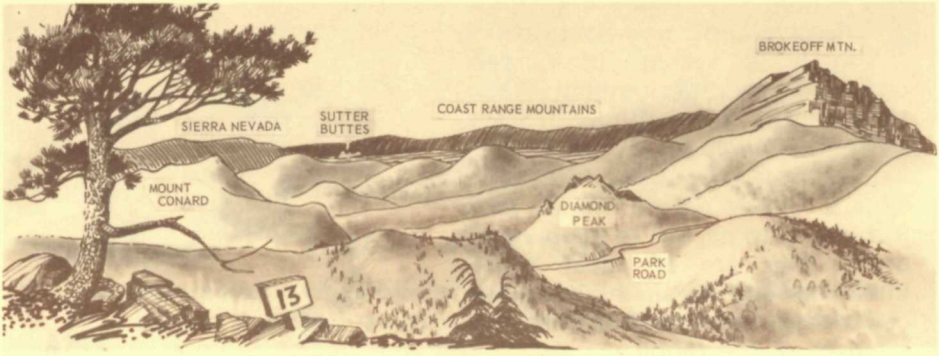
Pikas collect lupines and dry them in "haystacks" before storing them deep in the loose rocks for winter food.

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 that allow them to survive the powerful winter wind and deep snow.

MOUNTAIN HEMLOCK

11 Pinemat manzanita, like other plants that grow in this fierce environment, 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 Lighting storms are frequent near timberline, but because vegetation is sparse, fires do not normally spread to any extent.



PANORAMIC VIEW FROM STAKE 13

13 All of the mountains in the Cascade Range, including Lassen Peak and Mt. Tehama, are volcanoes. The Sierra Nevada and the Coastal Ranges 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 comes early in the high mountains. This pattern is evident by the very thin growth rings on the trunk of this 400-year-old cut tree.

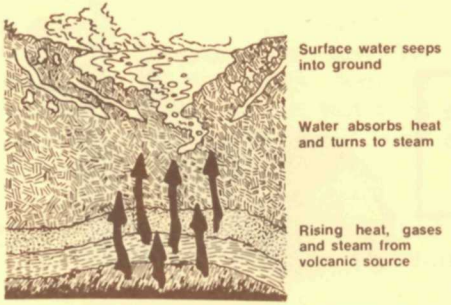
15 Bumpass Hell testifies to the existence of a mass of cooling lava perhaps miles beneath the earth's crust. Bumpass Hell is not one of Mt. Tehama's main vents, but lies on the slope outside the caldera of the former volcano. It is one of many fissures or faults in the region between the Sierra Nevada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

Bumpass Hell was named after 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 at this point. 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, is 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 The magma chamber beneath you is giving off hot steam and volcanic fumes including hydrogen sulphide. This 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 vicinity of the magma chamber. Then it returns to the surface again as steam. Most of the steam coming from Bumpass Hell originates as surface water. **A short spur trail leads to an interesting boiling spring.**

The numbered self-guiding trail continues on the left. A longer but gentler trail is available directly in front of you. You may use either trail to descend into the hydrothermal basin and return.

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**

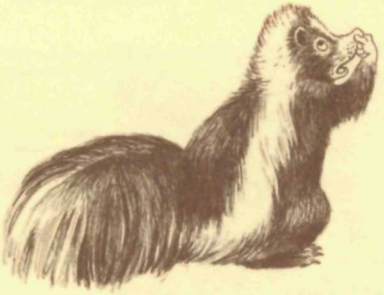
19 Bumpass Hell is a barren but colorful place. High temperatures combine with high concentrations of sulphur compounds and other materials to create an environment that is inhospitable to plants and animals. The difference in the abilities of living forms to tolerate these conditions is illustrated by bog kalmia, pink heather and rushes. You will notice that 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 decomposes easily under normal conditions, but sulphuric acid and hot steam have greatly accelerated 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 other thermal features. Bumpass Hell, Boiling Springs Lake, Devils Kitchen and Sulphur Works probably all tap the same giant reservoir.

DON'T BE A STINKER. Please *do not take samples or disturb* natural features.



23 The lack of sufficient water to dilute sulphuric acid results in the incomplete decomposition of the lava. This process produces the clay that is found in muddy pools such as this.

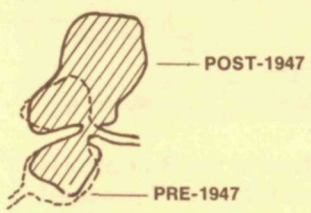
24 Much of the whitish material on these mounds is a non-precious form of opal. It is a product of complete decomposition of lavas when adequate water is absent.

25 This dried 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 "fool's gold." This iron compound is a product of chemical reactions in thermal waters. In large pieces, fool's gold has the gold color and metallic luster that gives it its name. Other iron compounds cause the red, yellow and tan stains.

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.



WEST PYRITE POOL

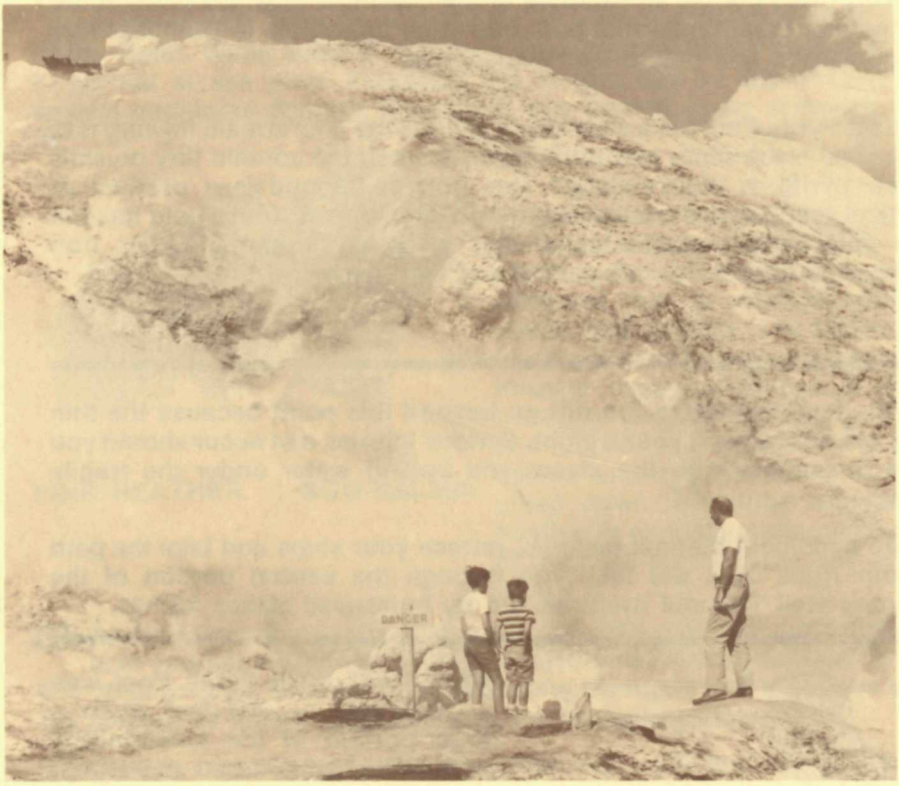
27 In 1947 West Pyrite Pool was enlarged by 800 feet when a large portion of the surrounding crust collapsed to create the largest sudden change in topography in Bumpass Hell that has ever been recorded.

28 Mudpots are an intermediate thermal feature between hot springs that have an abundance of water and fumaroles that are dry. The force of the steam here is strong enough to splash hot mud and build up a rim creating a "mud volcano."

29 Acid, steam, rain and frost will continue to attack these rounded boulders until they too are reduced to 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 Bumpass Hell can be thought of as a window into the inner geology of our planet. These hydrothermal features are surface clues to the enormous forces operating at great depth that will reshape this land for millions of years. Enjoy them safely, learn from them, and protect them for future generations.



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, or take the more gentle trail to the left.

We hope that this leaflet has helped to make your walk more enjoyable.
Please return this leaflet to the leaflet box
or put 30¢ in the box if you wish to buy the pamphlet.

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