A SELF-GUIDED TOUR OF ROUND TOP VOLCANOES

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Robert Sibley Volcanic Regional Preserve features a complex volcanic center that was the source, 10 million years ago, of most of the lavas that underlie the ridges from Inspiration Point in Tilden Regional Park to Moraga. Round Top, one of the highest peaks in the Berkeley Hills, consists of lavas, breccias (unsorted mixtures of fine and coarse volcanic deris) and tuffs (lithified volcanic ash—ash that has become stone) that once filled a volcano.

Though Round Top was once the infilling of a great cauldron, it stands out today because it was originally surrounded by "incompetent" (easily eroded) sedimentary rocks of the Orinda Formation, which have eroded away. During the past 10 million years the Berkeley Hills were uplifted on a gigantic scale because of strains on the Hayward and Moraga fault systems. This uplift folded the rock formations, and the Round Top vent complex was tilted on its side. Hence, folding and erosion have exposed a cross section of a great volcano, right down to its roots, providing an unsurpassed outdoor laboratory for the study of volcanism in the Central Coast ranges.

The blocks of stone scattered everywhere around the flanks of Round Top are basalt lava (a hard, dense, dark volcanic rock). Lava within the vent has been dated at UC Berkeley, by the potassium-argon radioisotope dating method, at 9.5 million years before present.

A great diversity of volcanic phenomena is preserved for study at Sibley. Basaltic dikes (feeders of the vents), tuff-breccias (ash containing a scattered jumble of blocks and chunks of lava), lava flows, red-baked cinder piles, air-fall tuffs and the major vent itself can all be seen first-hand in the course of an easy hike. Numbered posts, which correspond to the numbered descriptions below, have been placed at some of the most interesting outcrops.

1 To visit this site, walk up the paved road to the EBMUD water tank. A dark basalt dike, an important feeder of lava to the caldera, cuts through a sequence of tuff-breccias (brown) and pebbly mudstones (gray), all inside and near the bottom of the caldera. The mudstones indicate ponding of water; the tuff-breccias are the remains of landslides and blockfalls into the pit from the surrounding walls.

2 Note Orinda Formation river sands and gravels on the left against basalt lava on the right. This is part of the wall of the caldera. As you walked along the road to this point, you passed the steep cliffs below the summit installation. These cliffs expose mostly colluvium (recently accumulated slope debris), but there are also numerous outcrops of cataclastic basalt flows that look much like the colluvium. Cataclastic means the flows were shattered into coarse blocks by violent motions within the caldera — perhaps by collapsing into voids created by eruptions of later lavas.

3 These tuff-breccias originated when fluid mixtures of ash, lapilli (small pieces of lava, and pebbles derived from the Orinda gravels) and blocks of lava, perhaps saturated by rain, slurried and rumbled down the inside slopes of the volcano. In this outcrop there are two grades of breccia, the one at the bottom and the one to the right, bearing a much higher proportion of broken-up chunks of lava.

4 This quarry pit was made by quarry operations in which huge amounts of massive basalt lava were removed. The result is a tremendous boon to geology, for the pit exposes the interior of the Round Top volcano. You are standing on bedded tuff-breccias, which filled much of the caldera, settling at times into a small lake. To the left (north end of the pit) the layers of tuff-breccia curve around the pit, giving a hint of the inner parts of the volcano walls that originally stood above the surrounding terrain as a Miocene hill or peak. This unit also curves eastward through the bay-laurel grove in the gully to the right. The steep wall across the pit consists of lava that formed the basalt dome. Eventually the Round Top vent completely buried itself in basalt flows. From this point, note the view of Mt. Diablo, which, though it contains some submarine volcanic rocks, is not, and never was, a volcano.

5 This roadcut exposes Orinda Formation river gravels, sands and mudstones. A cross-cutting basalt dike at the left end feeds into the overlying volcanics. The red streaks and layers in these river beds were caused by oxidation of iron in the sediments. Such varicolored "redbeds" are explored worldwide for the fossils of plants and animals they contain. Elsewhere in the Preserve, bands of more intense red are found at the tops and bottoms of lava flows. In such cases iron was oxidized and reddened by baking; these bands are called "bake zones." A related process occurs when a brushfire reddens rocks and soil. To see Post 6, walk down the road about 100 feet past Post 5, then bear to the right.

6 Before you is a wall with basalt on the left and Orinda mudstones on the right. The bedding in the mudstones is disrupted, giving the appearance of drag-folding resulting from relative uplift of the lava occurring during the past 10 million years. Alternatively, the disruption of the mudstones may have occurred earlier, at the time of volcanic activity. This site was close to, or was in, the wall of the caldera, and would have been subject to all kinds of slumping, sliding and plowing. The "exotic" large sandstone blocks lying about were torn from very ancient Cretaceous (Age of Dinosaurs) rocks by the ascending lavas. The quarrymen took the lava, but left the sandstone here. To see Post 7, proceed northwest along the main road, then take the first right.

7 Massive basalt was removed from this major quarry pit. The north wall shows a set of thick lava flows. They are tilted on edge, nearly vertical, with a bake zone at the base of the sequence (far left). The well-defined layers near the top of the face are jointing-units resulting from cooling. Another interesting outcrop is situated on the remnant of an old road along the southeast flank of this peak. There you can see a thick accumulation of cemented red-baked volcanic cinders. These kinds of deposits always indicate proximity of a vent. Loose deposits of comparable material are quarried at volcanic vents in Lake County, and the products end up as red-cinder mulch on gardens in the Bay Area.

8 This is a red-baked sequence of air-fall tuffs. At the base is a lava flow. Within the section are buff-colored thin bands that look like lava. They are really air-fall tuffs that were, for some reason, more strongly lithified than the other tuffs in the section. Volcanic ash, which is called tuff when lithified, generally consists of rock fragments, crystals and bits of glass ejected from a volcano. Most of the tuffs at Sibley have very little glass and would thus be called "lithic-crystal" tuffs. The thin, hard, buff-colored bands in this section are "vitric-lithic-crystal" because they contain glass shards.

9 This is a beautiful basalt lava flow. It is smooth and massive in its upper part, to the left. The lower part is vesicular and "jumbled." The lower parts of lava flows are often jumbled by turbulence and drag. The vesicles in this flow were caused by escaping gas. The zeolites, chalcedony, opal and calcite filling many of the vesicles were precipitated during and after cooling of the lava. Alternatively, the outcrop can be interpreted as two separate lava flows.

HOW MANY VOLCANOES? Round Top was the big one. There are smaller ones outside the Preserve on private property to the north and southeast. Another, of rhyolitic composition like the ash from Mount St. Helens, underlies the Lawrence Berkeley Laboratory and Little Grizzly Peak in Tilden Regional Park. About 9 million years ago it was erupting beside Round Top. Subsequently it was shifted about three and one-half miles northwest by movement along Wildcat Fault. That makes a total of four volcanoes.