



Emerald Bay State Park

National Natural Landmark 1969



Why Glaciers Formed

The glacial history of the Tahoe basin is inextricably linked to the geologic structure and seismic history of the region. The Tahoe basin straddles the boundary of the Sierra Nevada geomorphic province and the Basin and Range geomorphic province. On the west side of Lake Tahoe, crustal movement along the Sierra Frontal Fault system is responsible for the steep fault escarpment that leads to the crest of the Sierra. Lake Tahoe occupies a deep basin created by cumulative descent along the faults. The faulting—related to the uplift of the Sierra Nevada and the extension of the Basin and Range—remains active today. As the Sierra Nevada was uplifted, it created an orographic effect on weather patterns, causing the Sierra to capture an excessively large share of regional precipitation.

Features/Process:

Glacial geomorphology along a nascent plate boundary

The increased precipitation and the higher elevations combined to increase moisture and snow accumulation in the Sierra Nevada. The uplift and increased precipitation set the stage for multiple episodes of Sierran glaciations during the Pleistocene Epoch

when global climate was much cooler. Glaciers fed by abundant snowfall formed on the elevated Sierran peaks and sculpted the valleys and lakes on the western slopes. On the east side of Lake Tahoe, the more rounded landforms of the Carson Range were not as sculpted by glaciers—being in the drier rain shadow.

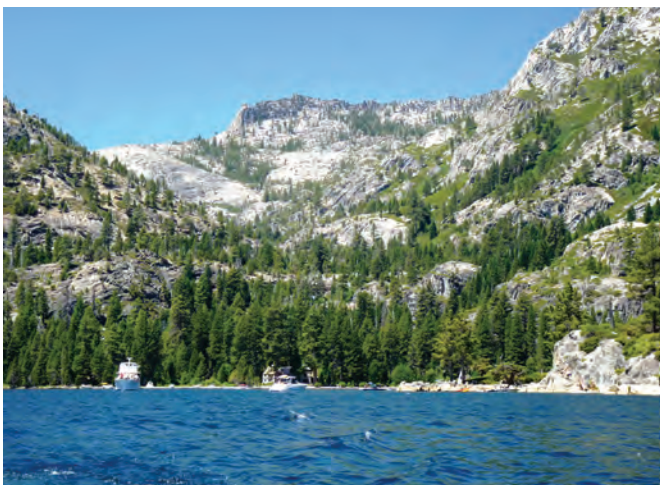
What the Glaciers Did

Glaciers plowed down canyons and then retreated during multiple (four to six) cycles of global warming and cooling (glacials and interglacials). Each glacial period may have lasted several thousand years. With each advance of the glaciers, evidence of previous lesser advances was obliterated. The two most recent glacials were the Tahoe Stage (~160,000 years ago) and the less extensive Tioga Stage (~20,000 years ago). The glaciers whittled away peaks, broadened canyons, and gouged lake basins. Rock was broken and pulverized into glacial till. The till was plowed and piled along the margins (lateral moraines) and front (terminal moraine—the “mouth” of Emerald Bay) of the glaciers.

During the Tahoe Stage, long fingers of ice descended stream valleys from the highest mountain peaks down toward Lake Tahoe. The subsequent Tioga Stage re-worked the glacial deposits, further scraped the landscape, deposited lateral and terminal moraines and formed the lake basins along the southwestern shore of Lake Tahoe.

Emerald Bay owes its origin to a four-mile long glacier that formed on the north slopes of Dicks Peak (elevation 9,974 feet), plowed its way down Eagle Creek, and probably extended into Lake Tahoe (elevation 6,229 feet). The lateral moraines flank the bay. During the more extensive Tahoe Stage, the glacier likely merged with another glacier emanating from Rockbound Valley at higher elevation in the Desolation Wilderness.

If the level of Lake Tahoe dropped just ten feet, Emerald Bay would become a separate lake, just like neighboring Fallen Leaf Lake and Cascade Lake. This may have



Why it's important: Emerald Bay is California State Park system's premier glacial park—owing its spectacular scenery and dramatic alpine peaks, ridges, and crystalline lake to the scouring action of glaciers that existed at various times during the Pleistocene Epoch (11,500 to 1,800,000 years ago). Glaciers as thick as several hundred feet buried all but the highest peaks of the Sierra and fingers of ice pushed down from the Sierran crest and gouged out stream canyons, scraped off soil and weathered rock, deposited moraines and carved out lake basins.



What you can see: Emerald Bay fills a large, oval depression gouged out by a series of glaciers and is surrounded by glacial deposits. Fannette Island is a glacial feature called a “roche moutonnée (translates to “sheep rock”) due to a semblance of a grazing sheep. The shape was carved and abraded by the overriding glacier that left behind the resistant knob that is Fannette Island. Recent landsliding and vigorous stream erosion modify the surrounding steep terrain.

occurred during a prolonged dry period between 1750 and 1850 when lake levels were several feet lower as indicated by submerged stumps just below the lake shoreline. Even older stumps are found in deeper waters, 60 to 70 feet below the surface. These trees likely grew during a prolonged drought (~5,000 to 6,300 years ago), known as the Altithermal, a period that was warmer and drier than today. At that time Emerald Bay was most certainly a separate lake, if it wasn't dry.

After the Glaciers

As the climate warmed, the glaciers gradually melted and retreated. The streams were vigorous, and full of meltwater and glacial sediments that washed into Lake Tahoe. Some of those sediments were deposited as a large delta off of Emerald Point. Over thousands of years, soils developed on the granitic valley slopes and conifer forests took root. The thin soils of decomposed granite on the slopes are very erodible.

The granitic (mostly granodiorite) bedrock exposed by the glaciers is evident throughout the area around Emerald Bay. The deposits of glacial till (a loose assortment of boulders, small rocks, and soil) form linear hills (moraines) that flank



the bay. The bedrock is fractured into great slabs which occasionally break loose from hillsides. This can be seen as piles of blocky rock at the base of slopes along Eagle Creek. The scars of large landslides that damaged the highway in 1955 and 1980 and avalanche chutes are evident in the park and remind us that the forces of nature are still at work shaping the landscape, albeit at a “glacial” pace.

Final Thoughts

The glacial and post-glacial events experienced by this beautiful landscape provide powerfully instructive tools that can lead us to better understand the natural and wildly fluctuating climatic conditions that shape the land of today.

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