

The Geological History of Van Norden Meadow

The Ancient Batholith

By John Cobourn

About 70 million years ago, the movement of the gigantic Pacific Crustal Plate against the North American plate caused the California subduction zone, where oceanic crust was dragged down under the continental plate. The tremendous heat and pressure caused huge masses of rock to melt into red hot magma, which rose like massive hot air balloons, melting the rock above, but not reaching the surface. These took thousands of years to cool, forming our local igneous bedrock (granodiorite) which underlies Van Norden and all of the Sierra Crest.

The Volcanic Era

Much later, about 15-30 million years ago, many volcanic eruptions in the northern Sierra covered the igneous batholith described above with volcanic rock (tuff, andesite, basalt lahar, conglomerate, etc.) Donner Summit had several volcanic vents. Mount Lincoln and Castle Peak may have been separate volcanoes, or they could be remnants of a large volcanic mountain bigger than both of them. Devil's Peak appears to be a volcanic plug.

The Uplift

These volcanic peaks weathered for another ten million years or so, after the volcanoes became inactive. Then, about 5 million years ago, the whole Sierra range began to rise again, as a series of thrust faults were activated by continued plate tectonic activity. The resulting uplift continued for millions of years, right up to the present. Our occasional local earthquakes are signs that the Sierra is still rising in our area.

The Ice Ages

The final geologic event, which gave shape to our area, was the age of glaciation. In a series of four or five ice ages, beginning around one million years ago and ending just ten or twelve thousand years ago, enormous glaciers blanketed the Sierra and carved the range into its current topography. These glaciers accumulated when the climate grew cold for thousands of years, and snow piled up so deep that it turned to sheets of solid ice thousands of feet thick. In the zones of deepest accumulations, high on the Sierra Crest, massive ice caps covered the range, and glaciers poured off those ice caps in all directions.

One such wonder was the mighty Soda Springs Ice Cap, which covered all of the Van Norden Meadow and, at times, all of Serene Lakes too. This mountain of ice carved away at Mount Lincoln and Castle Peak, carrying much of their volcanic peaks off to the lowlands. As new ice formed on the ice cap, a massive, slow moving river of ice actually flowed westward down past Hampshire Rocks at Rainbow exit, carving the South Yuba River's canyon. Another glacier plunged eastward over the brink of the thrust faults, carving the Donner Pass rock climbing area and continuing all the way to Truckee. This glacier actually excavated Donner Lake and dammed it with a terminal moraine at its east end.

The floor of the Soda Springs Ice Cap sat for thousands of years during each successive ice age under thousands of feet of ice. This ice not only carved away at the old volcanic peaks, but also carried away huge masses of granodiorite from the underlying batholith. This igneous rock can still be appreciated on the summit of Donner Peak just north of Mt. Judah. Most other local summits are volcanic rock. The many huge granite boulders scattered around the floor of the Van Norden meadow were carried from such peaks by moving ice, then placed gently on top of the glacial till by the melting glaciers at the end of their mighty reign. Such boulders, which are found everywhere in Donner Summit, are known as glacial erratics.

After the Ice Ages

Since the last glaciers melted 10-12 thousand years ago, the shape of our summit area has not changed very much. Water and wind erosion have continued the weathering process, but our dominant landforms are all glacial in character. There was no forest here when the ice melted. Indeed there was nothing resembling topsoil - just sand, gravel and broken rocks. The rich vegetation we see today developed slowly, and only after primitive lichens, mosses and other tundra species colonized the area and began the process of soil formation. Our local forests are the result of 10 thousand years of biological succession. Our remnant stands of old growth probably contain some of the biggest trees to have developed here since the glaciers melted.

The Van Norden meadow, which was discovered by the early white explorers and which became a resting ground for tired wagon trains traversing the Emigrant Trail, was originally known as Summit Valley. It was a broad open meadow, which also had evolved since the ice cap melted. To the wagon train emigrants, it represented arrival in the promised land. It was naturally a wetland because it was the lowest point in the area, and all groundwater in the volcanic rocks and the many glacial moraines flowed to and discharged in the Van Norden meadow. This still occurs, and in the spring hikers in the meadow find many areas where water bubbles up out of the ground and discharges into the rich wetland that is again colonizing the meadow, since the dam was breached in the mid 70's.