



Pyramid Creek Geologic Special Interest Area Eldorado National Forest

The Geology That You See

Taking a short hike

from the Pyramid Creek Trailhead, you will find easily accessible exposures of *petrographic* features visible within the *granodiorite* bedrock and excellent views of late *Pleistocene* glaciation.

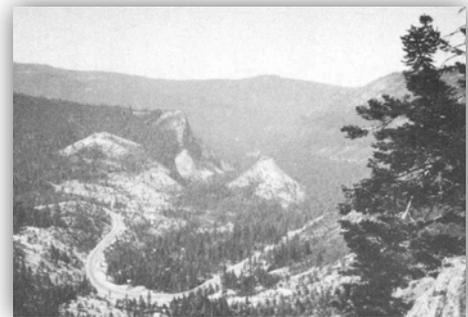
A great view of the broad U-shaped glaciated valley of Pyramid Creek can be seen from Highway 50, looking to the north from just east of the Pyramid Creek Trailhead. Horsetail Falls, a series of picturesque cascades and falls, marks one of the steps formed as the glacier scoured the ancient valley. As you walk along the trail that leaves Pyramid Creek Trailhead and follow Pyramid Creek, areas of *glacial polish*, *striations*, *erratic boulders* carried by glaciers, and glacially produced *gouge* and *chatter marks* can be seen.

A large nested pair of lateral moraines can be found to the east of Pyramid Creek. Highway 50 is built across these moraines. As you proceed east on Highway 50, watch for areas with large rounded boulders and notice how the road winds

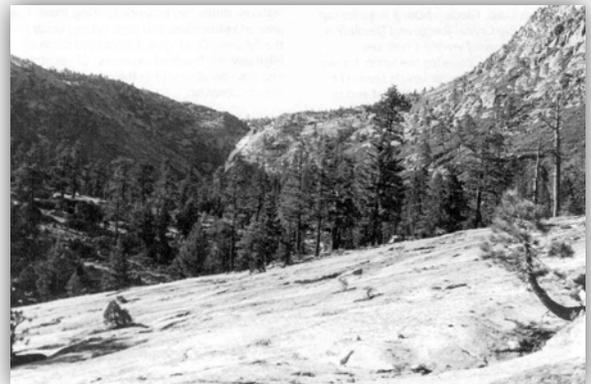
around the nose of the two moraines. The larger of the two moraines is the older one. It forms the arcuate shaped, linear ridgeline that extends out from the mountain front and extends to the flat just west of Camp Sacramento. This moraine was created by glacial during the *Tahoe* glaciation. The age of the Tahoe glaciation is generally considered to be from 118,000 to 56,000 years ago.

Nested inside of the larger moraine, and forming a lower, parallel ridgeline west of the main ridge, is the *Tioga* age lateral moraine. This moraine marks the maximum extent of the ice that accumulated during the Tioga glacial stage, which occurred about 20,000 years ago.

One of the other prominent features you see west of Pyramid Creek Trailhead is Lovers Leap. This high cliff was in part, shaped by the glaciers that poured out from Pyramid Creek. Glaciers from a large ice cap that covered much of the Crystal Range and Desolation Valley flowed down



View from Horsetail Falls looking to the south at Lovers Leap and Highway 50.



Glaciers sculpted the valley of Pyramid Creek flowing down the valley from Horsetail Falls and filling it almost to the top of Lover's Leap.



Striations indicate the direction the glacier flowed.

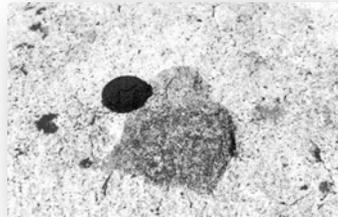
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Above: Chatter marks created by rocks frozen into the ice ripping at the surface.

The ancient granodiorite bedrock exposes features that record how this rock was formed.



Intrusions or xenoliths are the remnants of the parent rock. (note: lens cap gives a sense of size.)

Pyramid Creek and extended westward, covering the lower, rounded knob you can see just below Lovers Leap, but did not reach the top of Lovers Leap. The glacier covered the area near Strawberry and extended to the western edge of the large meadow at Strawberry.

As you follow the trail leaving Pyramid Creek Trailhead and get into open areas with large expanses where the granodiorite bedrock is exposed, you can see clusters of dark grey “blobs” of rock within the lighter colored granodiorite. These *inclusions* or *xenoliths* are commonly a few inches to several feet in diameter. These inclusions are thought to be remnants of the parent rock into which the granodiorite was intruded. If you can envision ancient sea floor sediments and volcanic rocks buried up to several miles deep. Then, some 130 million years ago, molten rock created by intense heating deep in the earth rose up into the older rocks, following fractures and other zones of weakness. In places, the molten rock ripped up or engulfed the original *country rock* which can now be seen as these darker colored xenoliths.



Erratic boulders left behind as the ice receded.

Some of the other features you can see within the granodiorite include veins of quartz and feldspar, and swirling patterns of black minerals which preserve evidence of the motions of the molten rock at the time when it was cooling and hardening. These unique patterns in the rock are known as *schlieren* and can be found in many outcrops of granitic rocks across the Sierra Nevada.

What Was That You Said?

Glossary

Many of the technical terms commonly used by geologists are shown in *italics*. Here are some definitions or explanations for these terms:

Bedrock is the term used to refer to the hard rock that underlies soil or unconsolidated sediments. **Country rock** is another term used for bedrock.

Erratic boulders are blocks of rock (often rounded) that were carried by past glaciers and dropped as the glaciers melted and receded.

Glacial polish, striations, gouge, and chatter marks are features formed by glacial ice and chunks of rock frozen into the base of the glacier move over the bedrock surface. Glacial polish is the smooth, polished surface of the bedrock, striations are linear scratches seen in the glacial polish, gouges are deeper, more pronounced scratches in the bedrock, and chatter marks are small, closely spaced crescentic grooves formed as frozen rocks held in the ice chip into the bedrock below.

Granodiorite is an igneous rock that formed deep in the earth and is generally light in color with scattered black or dark minerals

Inclusions are fragments of older rock within the younger, igneous rock. The term **xenolith** is from the Greek, meaning “foreign rock” and is the formal term used by geologists for inclusions in igneous rocks

Moraines are accumulations of loose soil and rock that were formed by past glaciers. There are many types of moraines. Moraines found along the edges of the glaciers are known as lateral moraines.

Petrographic—descriptions of the minerals and textures of rocks such as grain size, layering, etc.

Pleistocene is the geologic time period from about 1.8 million years ago to as recent as 10,000 years ago and includes the period of the world’s recent repeated glaciations.

Schlieren are irregular dark or light streaks in igneous rocks which differ in composition from the main mass.

Tahoe age and Tioga age are two time periods used to describe the ages of glaciers in the Sierra Nevada; Tioga glaciers were more recent than Tahoe age glaciers.