Mount Diablo State Park

Ancient Seafloor

From a distance Mount Diablo may resemble a volcano, but the mountain's origin is very different, although arguably just as exciting. Much of the core of Mount Diablo is made up of a special rock sequence/assemblage called an ophiolite. Ophiolites originate at the spreading centers of oceans and where oceanic plates collide with continental plates. On Mount Diablo, the ophiolite is dismembered.

Features:

Tectonic geomorphology of an ophiolite and surrounding sediments and fossils

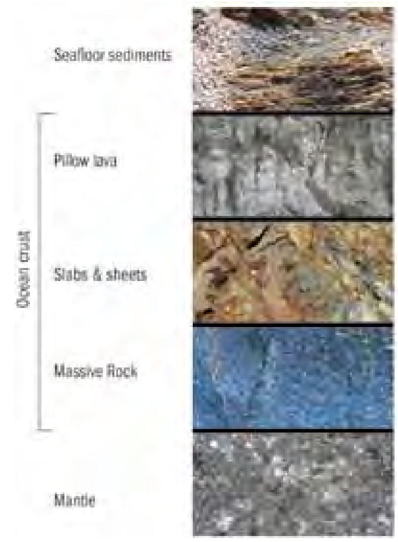
During ophiolite formation, molten rock from below the oceanic crust penetrates into seafloor fractures and either slowly cools and solidifies as sheets of diabase or erupts onto the seafloor and quickly cools to form pillow basalts (as found on Mitchell Peak). Basalt and diabase are chemically the same but differ in texture due to their different rates of cooling. Outcrops of pillow basalts have rounded shapes reminiscent of randomly stacked pillows.

Serpentinite, California's official state rock, originates deep in the mantle where the surrounding materials are very hot and semi-plastic. It typically finds its way to the earth's crust and surface by following paths of weakness and faults. Serpentinite crops out on the mountain as a narrow band of rocks northwest of the summit. Intermixed within the serpentinite are related rocks rarely found on the earth's surface: harzburgite and pyroxenite. These coarse-grained rocks came from a layer deep below the oceanic crust called the mantle.

Near Mount Diablo's summit, rocks of the Franciscan Complex (also formed during the subduction process) crop out. Included are fragments of basalt, shale, sandstone, and occasional blocks of blue-colored metamorphic rocks called blueschist. Also included are reddish beds of chert which are made of the skeletal remains of small sea creatures called radiolaria.

In contrast to an ophiolite, the Franciscan Complex is a chaotic mix of rocks scraped off the Farallon plate and plastered onto the edge of the North American plate as the two plates collided hundreds of millions of years ago. On land, the Franciscan Complex consists of large and small blocks of various rock types encased in a sheared matrix.

Ophiolite: A layered assemblage of rocks that formed as a section of oceanic crust. The crust forms at rifts in the oceanic crust such that a characteristic sequence of layers is formed. The rate of cooling of molten rock is controlled by the depth below the ocean floor where water quenches the rock. The deeper layers are cooled more slowly while the uppermost layers cool rapidly. Pillow basalts typify the upper layers while intermediate layers develop as vertical slabs and lowermost layers develop as massive rock.



Emergence of Land

Younger rocks surround the core of the mountain and provide evidence that subduction along the plate margin ended and the region was uplifted out of the sea during the Tertiary Period (2.6 to 65.5 million years ago). Layers of progressively younger rocks are found away from the mountain and in the surrounding valleys.

The “wind caves” found on the mountain are formed in Domengine Sandstone (deposited about 50 million years ago). These caves were not formed by wind, but were created by water that seeped through fractures and dissolved portions of the rock, eroding out the caves in the softened rock. Mineral concretions are also found in the sandstone, as resistant round cannonball shapes, formed by mineral deposits that armor the sandstone against erosion.

What you can see: Lofty Mount Diablo is a chunk of ancient sea floor that has been shoved up to form the most prominent mountain in the East Bay. It retains fragments of oceanic crust, underwater lava flows, a rich collection of marine and terrestrial fossils, folded and faulted rock outcrops, and caves that illustrate its transition from seafloor to the complex mountain of today.

Why it's important: Mount Diablo is a dominant topographic feature in northern California. It was established in 1851 as the initial point of the Mount Diablo Base Line and Meridian for land surveys spanning two-thirds of California and all of Nevada. The mountain's summit boasts spectacular panoramic views. Less well-known is the complicated geologic history that produced this intriguing landscape.

Current plate tectonic theory places the origin of the mountain thousands of miles southwest of its current location. The oceanic fragment was crammed and squeezed with other rocks for millions of years along the interface of the Pacific and North American plates. Mount Diablo provides excellent examples of the types of rocks and geologic processes that occur along a continually evolving plate margin.

Fossils

In addition to the microscopic radiolaria associated with the Franciscan chert near Mount Diablo's summit, some of the younger rocks are rich in fossils. The Briones Sandstone of Miocene age (23 my – 5 my) is particularly rich in shell fossils. The Pleistocene (less than 1.8 my) Green Valley Formation represents the final emergence of the area from the sea and includes fossils of mammals such as mastodons, camels, and saber-toothed cats.

Growth of a Mountain

Mount Diablo as an edifice is geologically young and only began to form about two million years ago during the Pliocene. Regional uplift has produced the steeply dipping beds that surround the mountain. Tilted beds that are more resistant to erosion tend to form distinctive hogbacks, which are sharp crested ridges that stand out in contrast to the adjacent more easily erodible beds.

Deformation continues today as the mountain is squeezed between the active Greenville and Concord faults. The growth of the mountain occurs episodically during large earthquakes along a buried fault under the mountain know as the Mount Diablo thrust fault. The fault has not moved historically, but scientists estimate that there is a 1% chance that it will produce a large earthquake in the next 30 years. Such earthquakes represent the continuing tectonic forces that have created, and will continue to shape Mount Diablo.

Final Thoughts

When this landmark became the basis of our survey system in 1851, we considered it dormant; we now know the mountain is still growing.

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