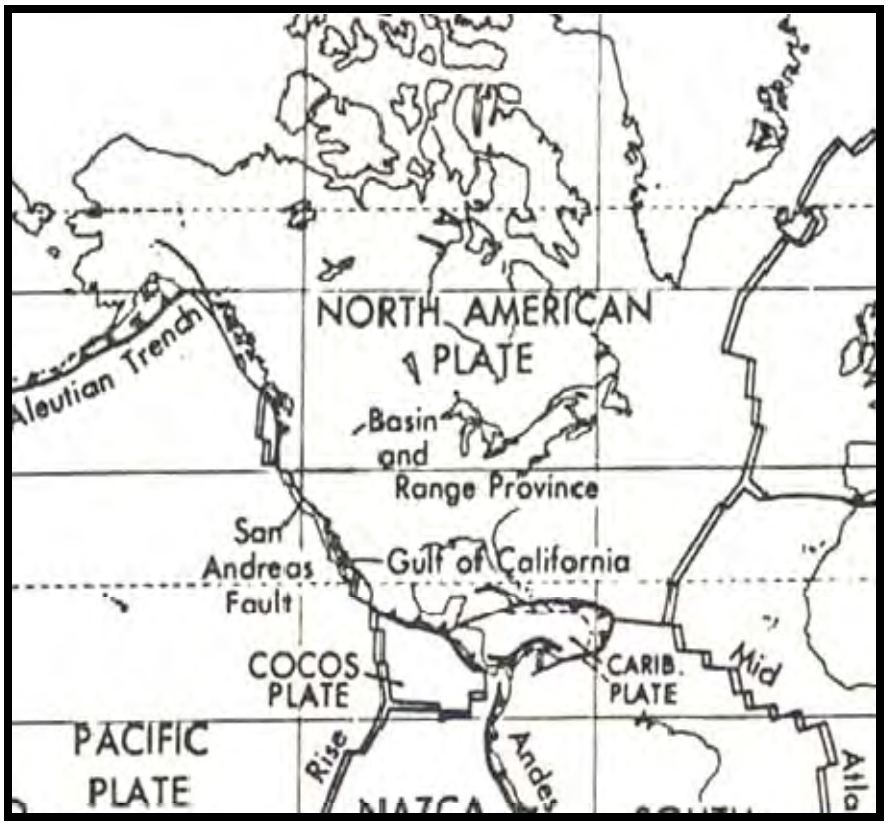
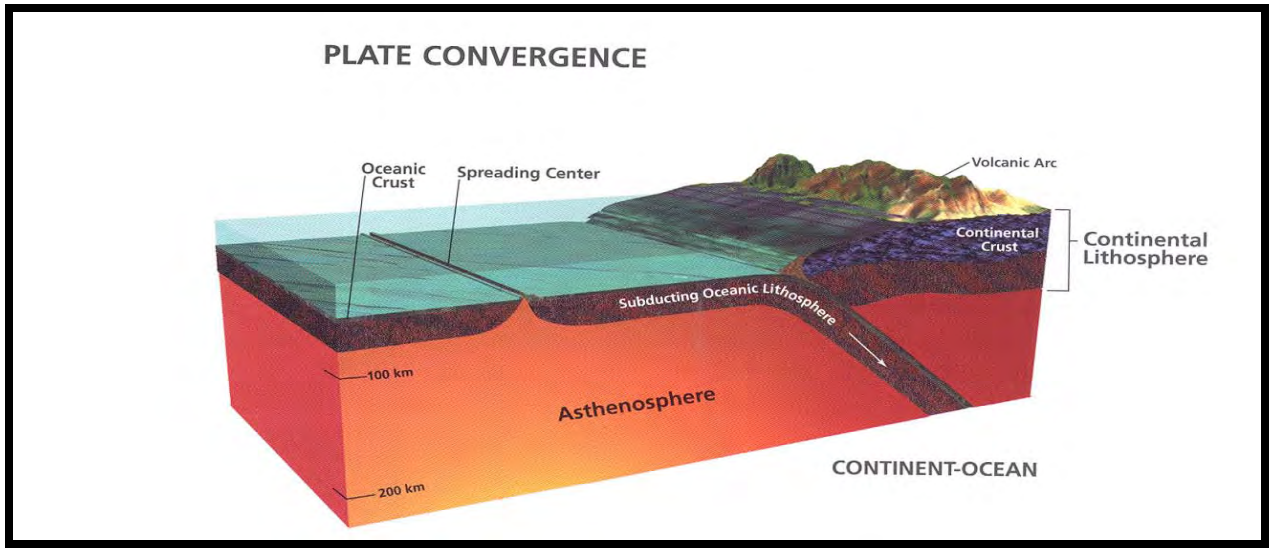
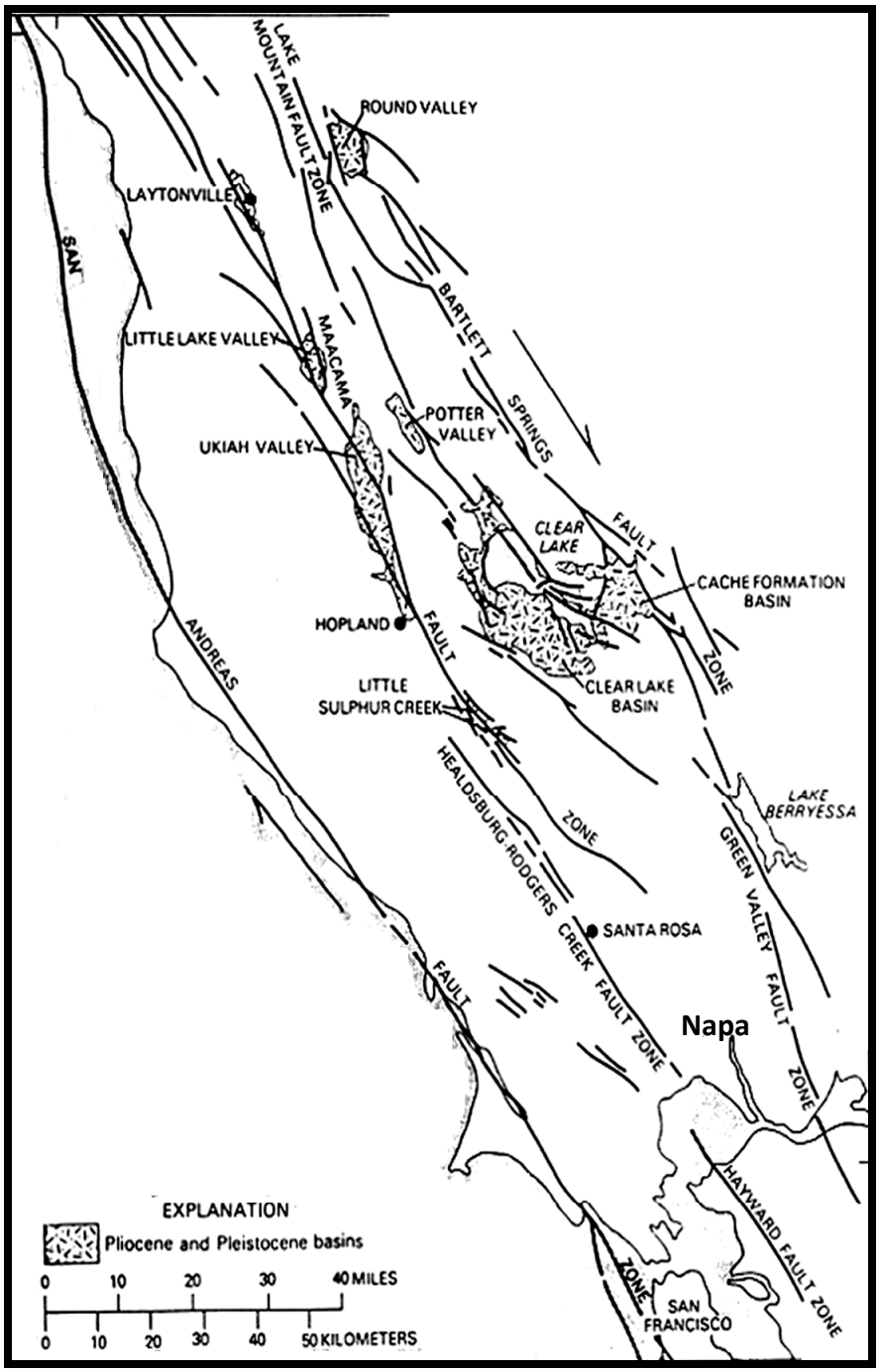
GEOLOGY OF NAPA VALLEY

The curving slope of Mt. St. Helena, the jagged face of Stags Leap, the vertical spires of the Calistoga Palisades, the wooded promontories of Mt. Veeder and Mt. John, the flatness of the valley floor – all are features of the Napa Valley produced by geologic processes



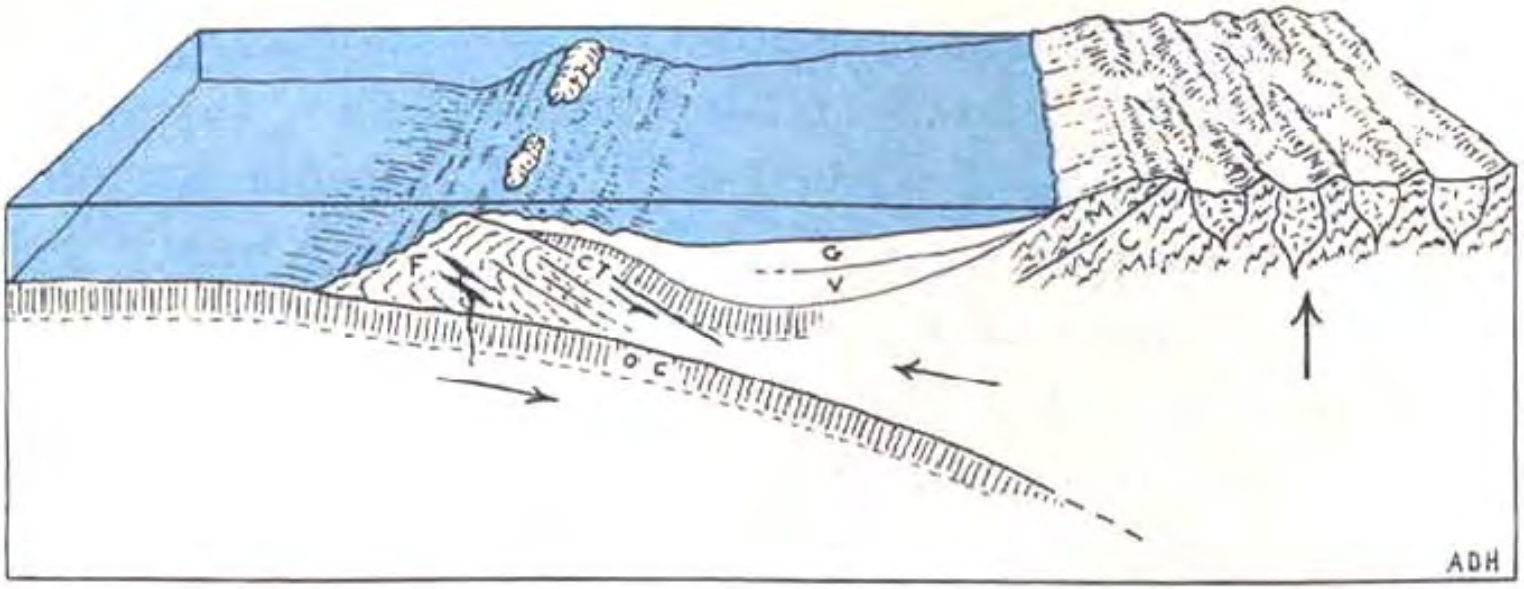
The continents were not always in the same positions as today. Like leaves upon a lake surface they have drifted ever so slowly apart from and into each other. As these 50 mile thick, massive plates come into contact they either slip over one another or smash head on creating massive heaps of mountains. In California the Pacific Plate subducted or slipped beneath the North American Plate. The rocks were smashed, ground and pushed up to form the coastal ranges. This process is incalculably slow in human terms and began over a hundred million years ago.





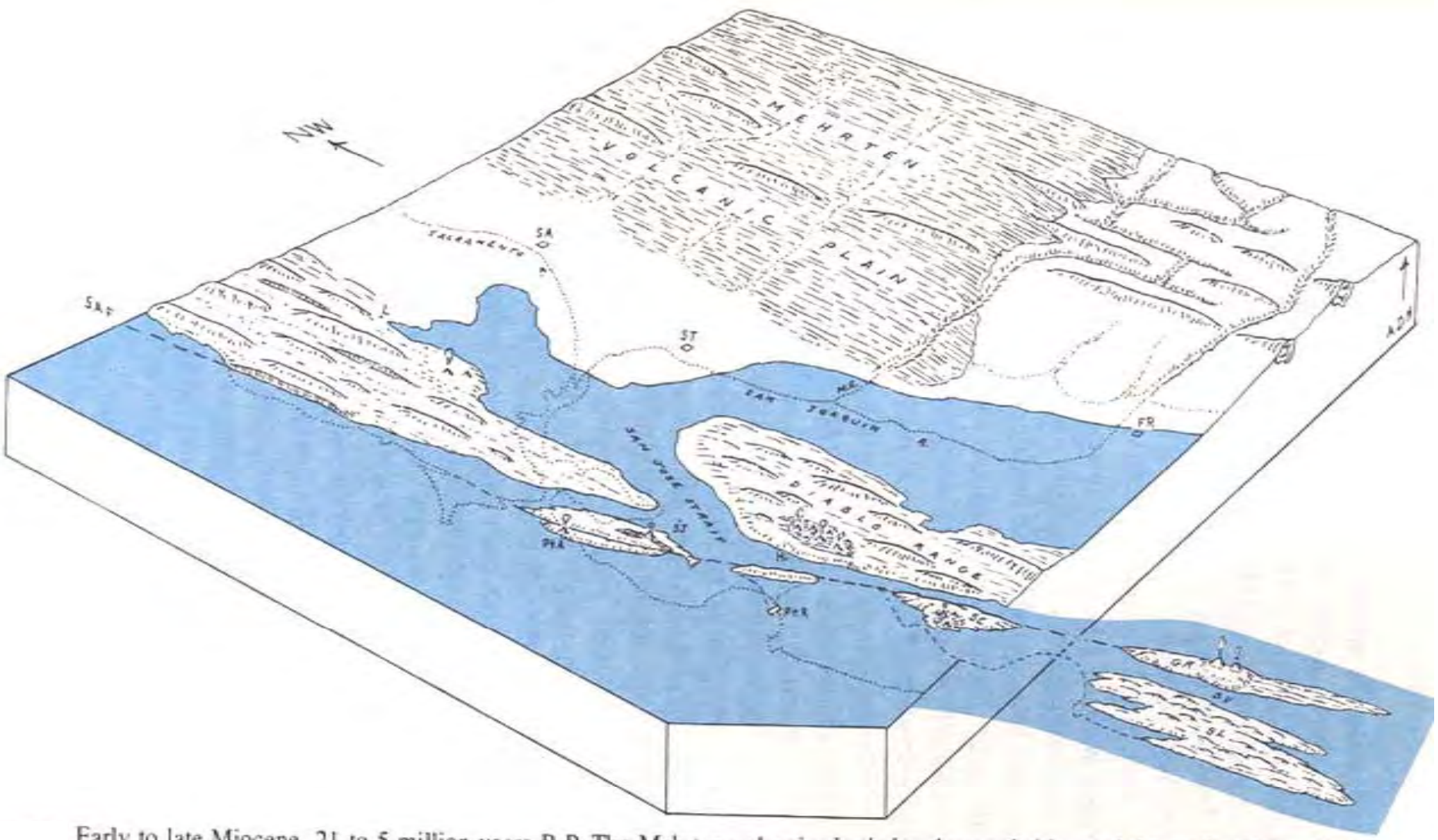
In California the San Andreas Fault is the current zone of movement between the plates. While often represented as a single line it is more like a system of joinery with numerous parallel cracks and fractures such as the Maacama, Rodgers Creek, Green Valley and West Napa faults.

San Andreas Fault in Monterey County



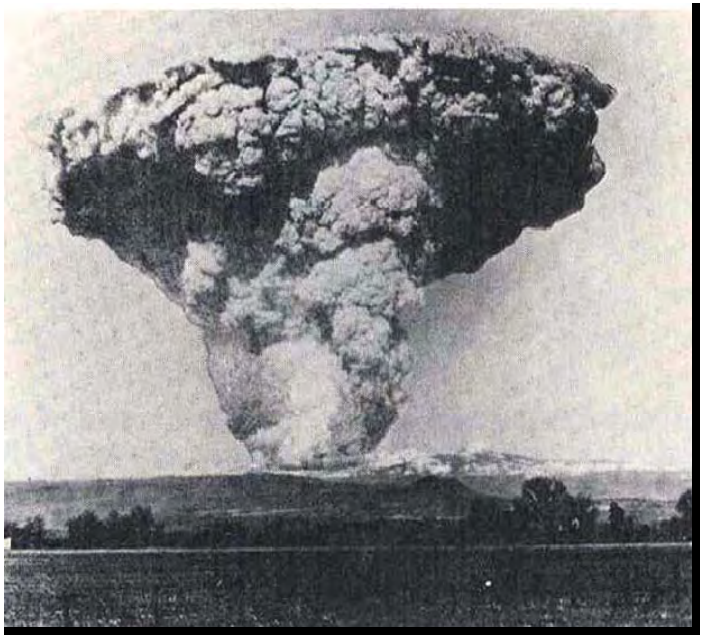
Late Cretaceous landscape, 100 to 65 million years B.P. Elevation of the Sierra resulted in accelerated stream erosion and removal of the volcanic cover and much of the metamorphic rock from above the granite batholiths. Considerable granitic debris (G) was added to the sediments in the offshore basin. In the trench, the accumulating sediments were crumpled and sheared and parts were forced under the edge of the basin sediments along the Coast Range Thrust (CT). The trench sediments comprise the present Franciscan Assemblage (F). The buckled edge of the upper plate appeared locally above water, probably as a string of islands. (OC—Oceanic crust.)

During most of the period of plate subduction Napa and much of Northern California was beneath the ocean. The Pacific shoreline was near the present location of the Sierra foothills. Between 10-20 million years ago uplift intensified and much of the coastal ranges became dry land. Illustration from Geologic History of Middle California by Arthur Howard.



Early to late Miocene, 21 to 5 million years B.P. The Mehrten volcanics buried and extended beyond the earlier Valley Springs volcanic deposits. The inland sea, at its maximum, reached to about the latitide of Sacramento. At its maximum, the sea probably connected to the open ocean through San Jose Strait. Volcanism was widespread throughout the Coast Ranges, the largest area being east of Hollister (H). Volcanic activity erupted in the Gabilan Range (GR) at the present site of Pinnacles National Monument. West of the San Andreas Fault, the forward elements of the moving oceanic block had entered Middle California. (FR—Fresno; GR—Gabilan Range; H—Hollister; MR—Merced River; Pt.A—Point Arena; Pt.R—Point Reyes; SA—Sacramento; SAF—San Andreas Fault; SC—Santa Cruz Range; SL—Santa Lucia Range; ST—Stockton; SV—Salinas Valley.)

Illustration from Geologic History of Middle California by Arthur Howard.



Ash cloud from volcanic eruption

Calistoga's geyser shows geothermal activity in the area

Glass Mountain near St. Helena is covered by obsidian or volcanic glass

Petrified forest west of Calistoga was a forest buried in volcanic ash

About 5 million years ago a large volcanic field stretched over 350 sq. miles from Fairfield to Petaluma and north to the Geysers. Violent explosive eruptions sent large amounts of ash hundreds of feet into the air. Sometimes lava flows followed this initial blast. For 5 million years volcanoes appeared, erupted, and went dormant. In some places soil developed and forests grew only to be buried by a later eruption.

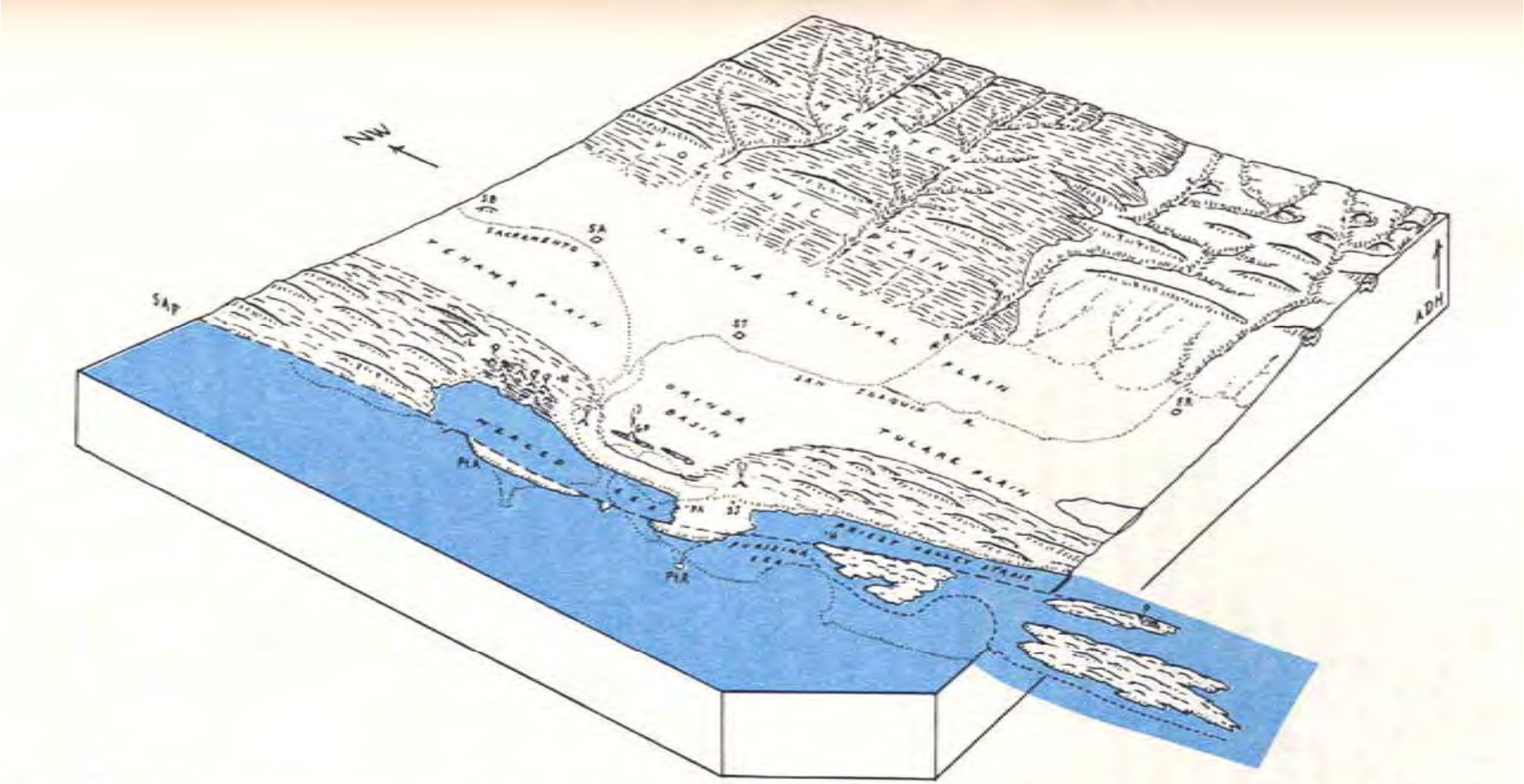
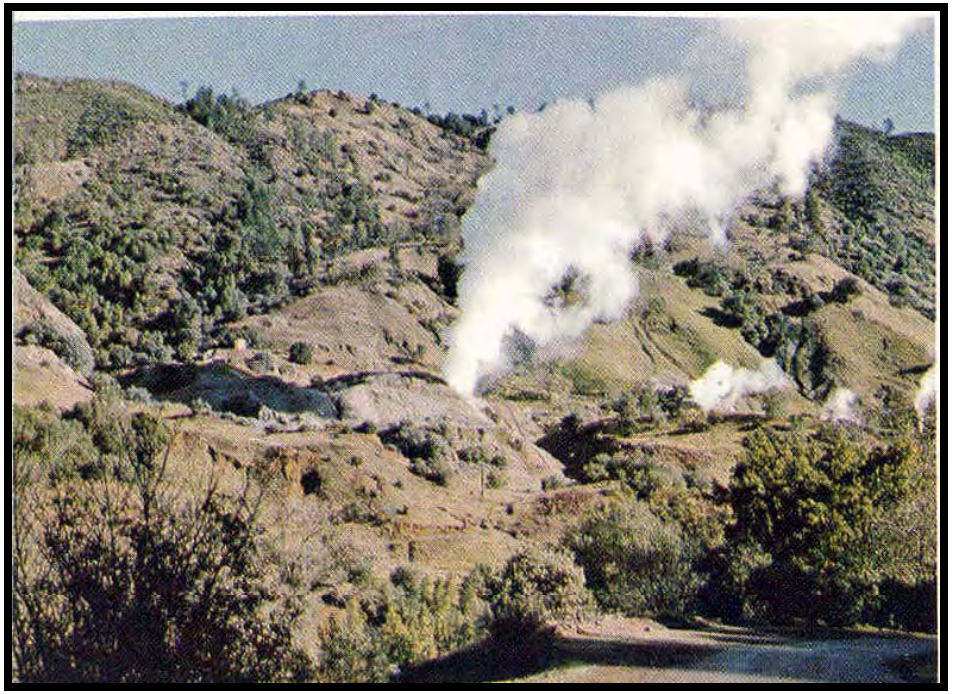


Figure 13. Early to late Pliocene landscape, 5 to 2 million years B.P. Erosion of the Sierra Nevada provided large quantities of sediment which were spread out in the Great Valley as the Laguna Alluvial Plain. South of the Mehrten Volcanic Plain, many granitic domes now made their appearance. The inland sea barely extended into Middle California at this time. A ridge now separated the Great Valley from the open sea. Sediment from the Coast Ranges formed the Tehama and Tulare plains and covered the floor of the Orinda Basin. The main center of volcanic activity had now shifted north of the San Francisco Bay region to the site of the Sonoma Range. The basin near Lower Lake (L) became the site of deposition of the Cache Creek beds. The Merced and Purisima seas indented the coast, and the latter connected with the inland sea by way of Priest Valley Strait. The Pinnacles volcanic rocks had been dropped down between parallel faults and preserved from erosion. (FR—Fresno; GP—Grizzly Peak; H—Hollister; L—Lower Lake; MR—Merced River; N—Napa; PA—Palo Alto; P—Pinnacles; Pt.A.—Point Arena; Pt.R—Point Reyes.)

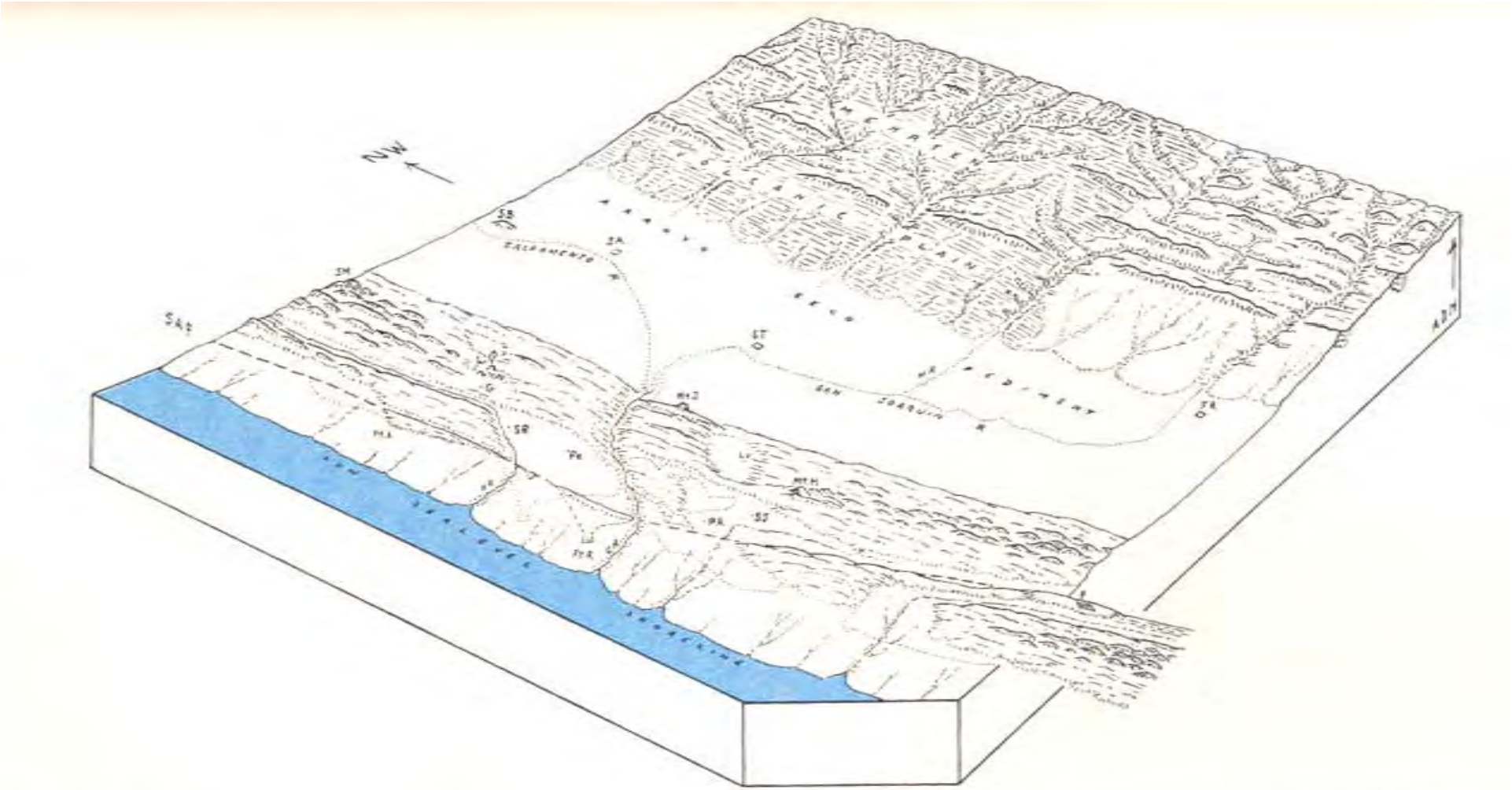
Illustration from Geologic History of Middle California by Arthur Howard.

The remnants of these volcanoes are prominent landmarks in Napa Valley – Stag's Leap, Calistoga Palisades and Mt. St. Helena. This mountain is capped with volcanic material but is not a volcanic vent.



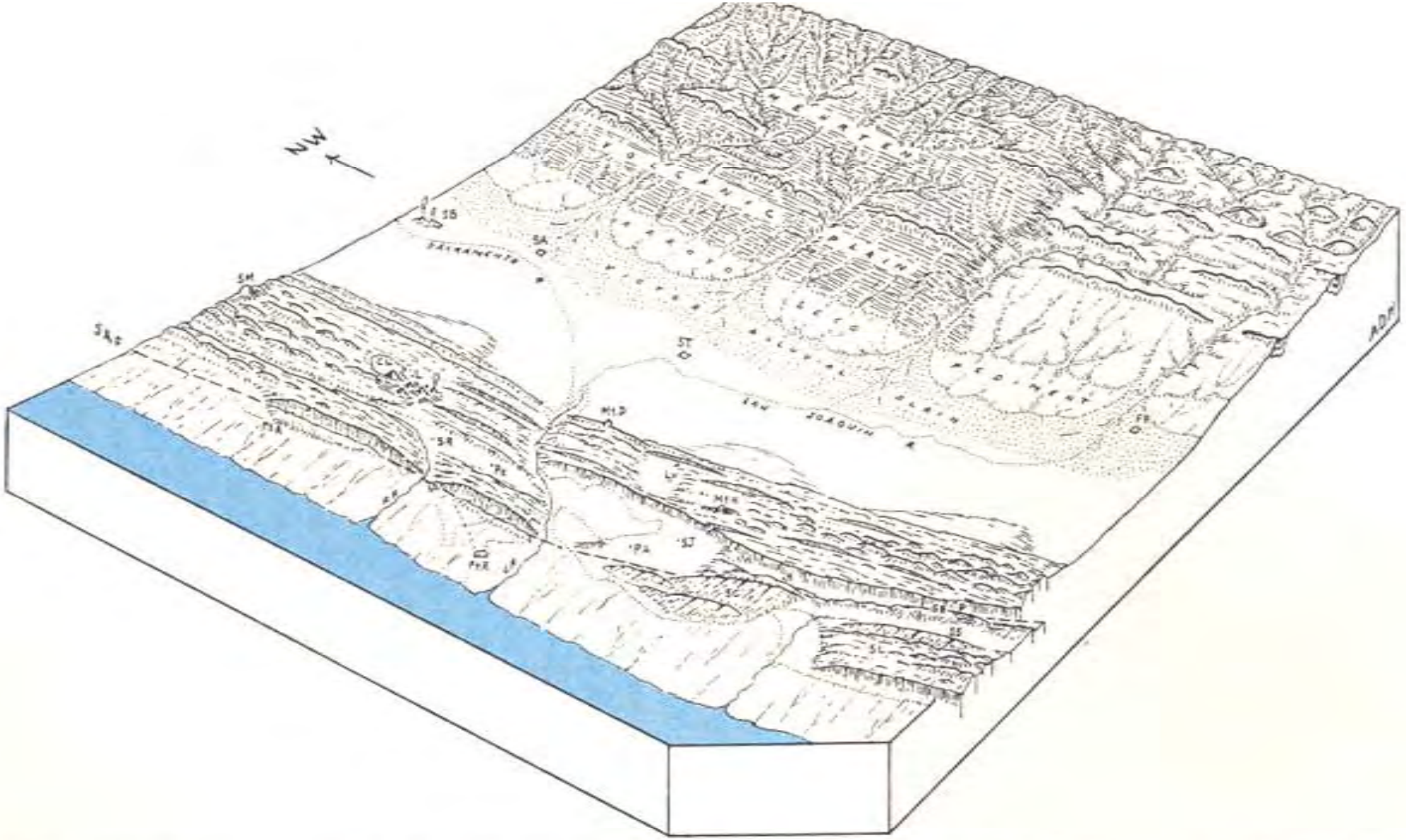
The active volcanic field is now in Lake County and the Geysers geothermal area. The last eruptions near Clear Lake occurred only 10,000 years ago.

Mt. Konocti is an active volcano



Great Ice Age—Phase I. The Pacific shoreline is shown during one of the glacial stages when much ocean water was locked up in great ice sheets on land. The drainage of the Great Valley now escaped seaward along approximately its present path. The basins and many of the valleys continued to serve as repositories of sediment, while the ridges were beveled except for residual mountain masses. The basin southwest of Lower Lake (L) became the site of intensive volcanic activity. The upper reaches of many Sierran valleys were now converted to glacial troughs. The Laguna Alluvial Plain was almost completely destroyed and replaced by a widespread erosion surface, the Arroyo Seco Pediment. (CR—California River; FR—Fresno; Lv—Livermore; MR—Merced River; Mt.D—Mount Diablo; Mt.H—Mount Hamilton P—Pinnacles; PA—Palo Alto; Pe—Petaluma; Pt.A—Point Arena; Pt.R—Point Reyes; RR—Russian River; SA—Sacramento; SB—Sutter Buttes; SJ—San Jose; SM—Snow Mountain; SR—Santa Rosa; ST—Stockton.)

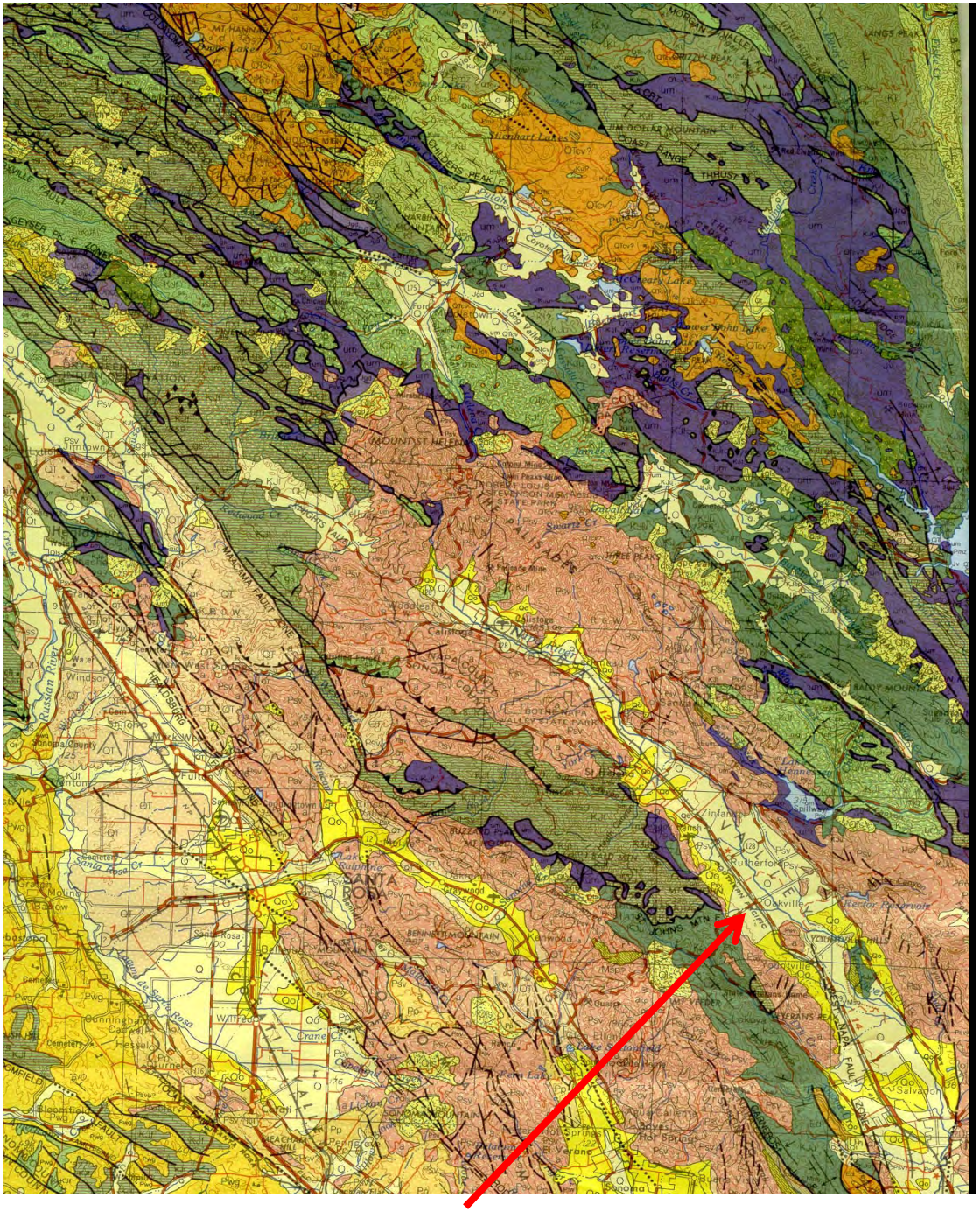
Illustration from Geologic History of Middle California by Arthur Howard.



Mid–Ice Age mountain-making, 1 million years B.P. The major topographic units of the Coast Ranges were blocked out at this time, mainly by faulting. The Arroyo Seco Pediment was now being dissected, and its debris was added to that from the Sierra to form the Victor Alluvial Plain. The landscape elements west of the San Andreas Fault were now close to their present-day positions. (CL—Clear Lake; CR—California River; FR—Fresno; GR—Gabilan Range; H—Hollister; L—Lower Lake; Lv—Livermore; Mt.D—Mount Diablo; Mt.H—Mount Hamilton; P—Pinnacles; PA—Palo Alto; Pe—Petaluma; Pt.A—Point Arena; Pt.R—Point Reyes; RR—Russian River; SA—Sacramento; SB—Sutter Buttes; SJ—San Jose; SL—Santa Lucia Range; SM—Snow Mountain; SR—Santa Rosa; SS—Sierra de Salinas; ST—Stockton.)

Illustration from Geologic History of Middle California by Arthur Howard.

The Napa Valley is a relatively recent feature formed by uplift of the mountains and downward movement of the adjacent valley. The ranges on the eastern side of the valley are primarily Sonoma Volcanic rock with some Great Valley Complex dating from the time of an inland sea covered the area. The western mountains are a combination of old sea floor sediments – the Franciscan Formation, and a cap of volcanic rock in some locations. Erosion from the mountains has filled the valley with alluvium creating a groundwater aquifer and rich soils.



GEOLOGIC MAP OF NAPA VALLEY AND NEARBY AREAS

ABBREVIATED EXPLANATION

Approximate stratigraphic relationships only; see Geologic Map Explanation for more accurate stratigraphic relationships and unit descriptions.

QUATERNARY

Holocene

- Alluvium
- Natural levee and channel deposits
- Basin deposits *(Alluvium)*
- Landslide deposits
- Dune and beach sand
- Intertidal deposits *(Peaty-mud)*

Pleistocene

- Older alluvium
- Modesto-Riverbank Formations *(Arkosic alluvium)*
- Terrace deposits
- Millerton Formation *(Marine and nonmarine clay, silt, sand and conglomerate)*
- Red Bluff Formation *(Gravel in reddish silty or sandy matrix)*
- Huichica and Glen Ellen Formations; Includes undifferentiated continental deposits. *(Fluvial gravel, silt, sand, and clay)*
- "Cache Formation" *(Pebbly sandstone, conglomerate, siltstone and tuff)*
- Tehama Formation *(Sand, silt, and volcaniclastic rocks)*
  Putah Tuff Member *(Ppt)*

TERTIARY

Pliocene

- Ohlson Ranch Formation *(Marine sandstone, siltstone, and conglomerate)*
- Wilson Grove Formation *(Marine sandstone, conglomerate, and tuff)*
- Unnamed continental deposits *(Poorly sorted sandstone and conglomerate)*
- Petaluma Formation *(Claystone, siltstone, mudstone; mostly nonmarine)*

Miocene

- Orinda (?) Formation *(Pebbly sandstone and conglomerate)*
- Drakes Bay Formation *(Marine siltstone and mudstone)*
- San Pablo Group *(Marine sandstone and shale)*
- Monterey Group *(Marine sandstone and shale)*
- Gallaway - Skooner Gulch Formations *(Marine sandstone and mudstone)*
- Laird Sandstone *(Marine quartzose feldspathic sandstone)*

Eocene

- Markley Sandstone *(Marine)*
- Nortonville Shale *(Marine)*
- Domengine Sandstone *(Marine)*
- Capay Formation *(Marine sandstone)*
- Unnamed Eocene marine rocks

Paleocene

- German Rancho Formation *(Marine sandstone and mudstone)*
- Martinez Formation *(Marine quartzose sandstone)*
- Point Reyes Formation *(Marine conglomerate and sandstone)*

CRETACEOUS

- Coastal Belt Franciscan *(Marine sandstone, shale, and conglomerate)*
- Gualala Formation *(Marine sandstone, mudstone, and conglomerate)*
- Upper Cretaceous *(Undifferentiated marine rocks)*
- Forbes Formation *(Marine shale and siltstone)*
- Guinda Formation *(Marine sandstone and mudstone)*
- Funks Formation *(Marine shale and sandstone)*
- Sites Formation *(Marine sandstone)*
- Yolo Formation *(Marine shale and sandstone)*
- Venado Formation *(Marine sandstone and conglomerate)*

Upper Cretaceous Great Valley Sequence

- Lower Cretaceous Great Valley Sequence *(Marine mudstone, sandstone, and conglomerate)* *(Klsp - detrital serpentine)*
- Lower Cretaceous-Upper Jurassic Great Valley Sequence *(Marine mudstone, siltstone, sandstone, and conglomerate)* *(KJsp - detrital serpentine)*

JURASSIC

- Franciscan Complex* *(ss-sandstone, shale, conglomerate; ch-chert; gs-greenstone; mg-metagraywacke)*
- Serpentinized ultramafic rocks *
- Metamorphic rocks of uncertain age. ls - limestone and marble *(Biotite schist and quartzite)*

* Horizontal pattern denotes melange terrane

- Clear Lake Volcanics *(d-dacite; a-andesite to basaltic rock; b-basalt; r-rhyolite; t-tuff and other pyroclastic rocks)* ✲ Quaternary cinder cone or volcano.
- Sonoma Volcanics *(b-basalt; a-andesite; r-rhyolite; t-tuff and other pyroclastic rocks)*
- Pinole Tuff
- Volcanic rocks of Burdell Mtn. *(Andesitic mudflow breccias and flows)*
- Putnam Peak Basalt
- Iversen Basalt
- Granitic rocks
- Spilite near Black Point

Coast Range Ophiolite

- Volcanic rocks, mainly basalt
- Gabbro and diabase
- Ultramafic rocks (Peridotite)-partly to completely serpentinized