

Geology of California & Pepperwood Preserve

With Nicole Myers



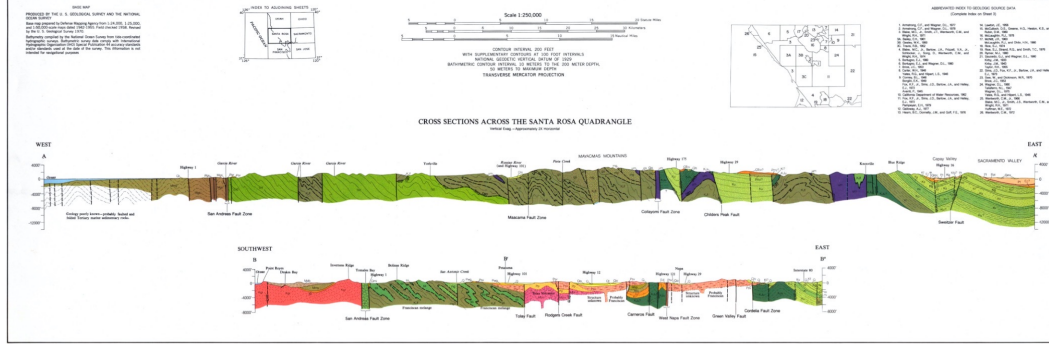
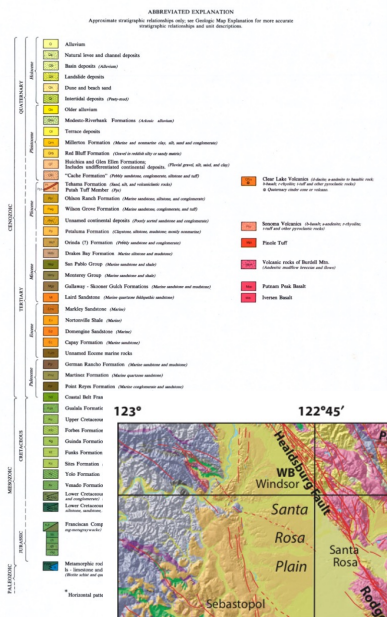
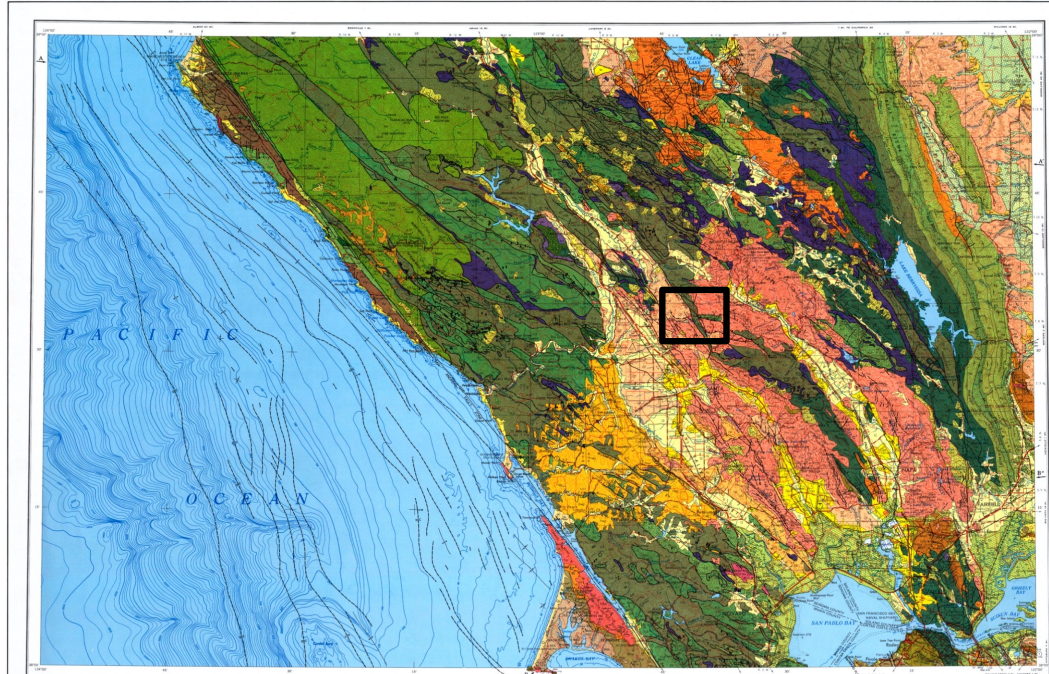
Handouts at:
[https://www.
appreciatingearth.com/
pepperwood](https://www.appreciatingearth.com/pepperwood)



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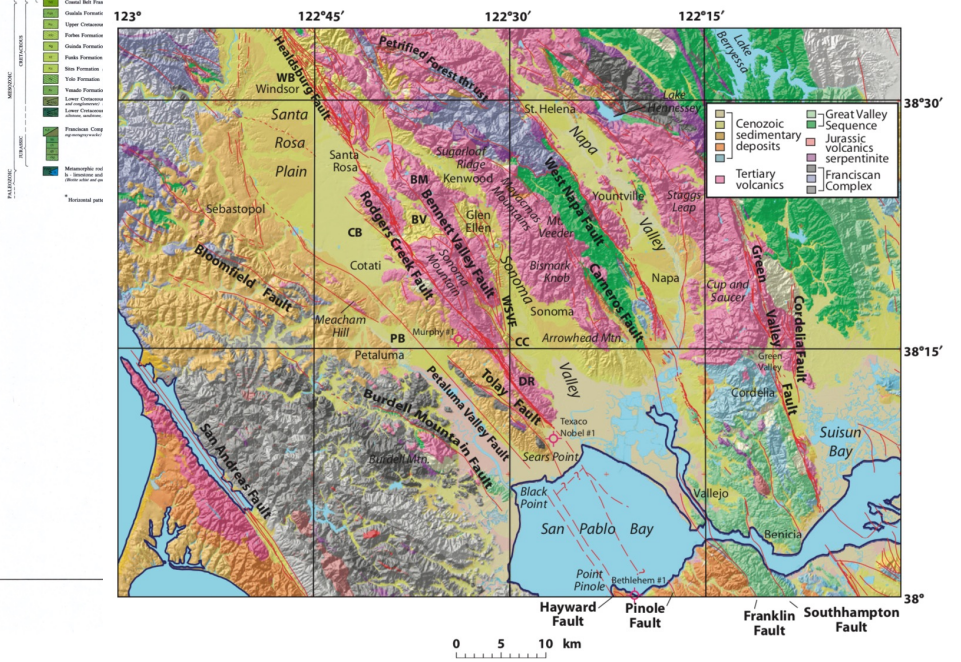
Links available at
<https://rockd.org/>



GEOLOGIC MAP OF THE SANTA ROSA QUADRANGLE, CALIFORNIA, 1:250,000
Compilation by
D.L. Wagner and E.J. Borgogno
Published 1982

GEOLOGIC MAPS

- Rocks = materials (minerals) & history
- Tectonics = landform formation & orientation



FORMING ROCKS

Rock:

- any naturally formed, nonliving, firm & coherent aggregate of mineral matter

Igneous Rocks:

- solidification of magma

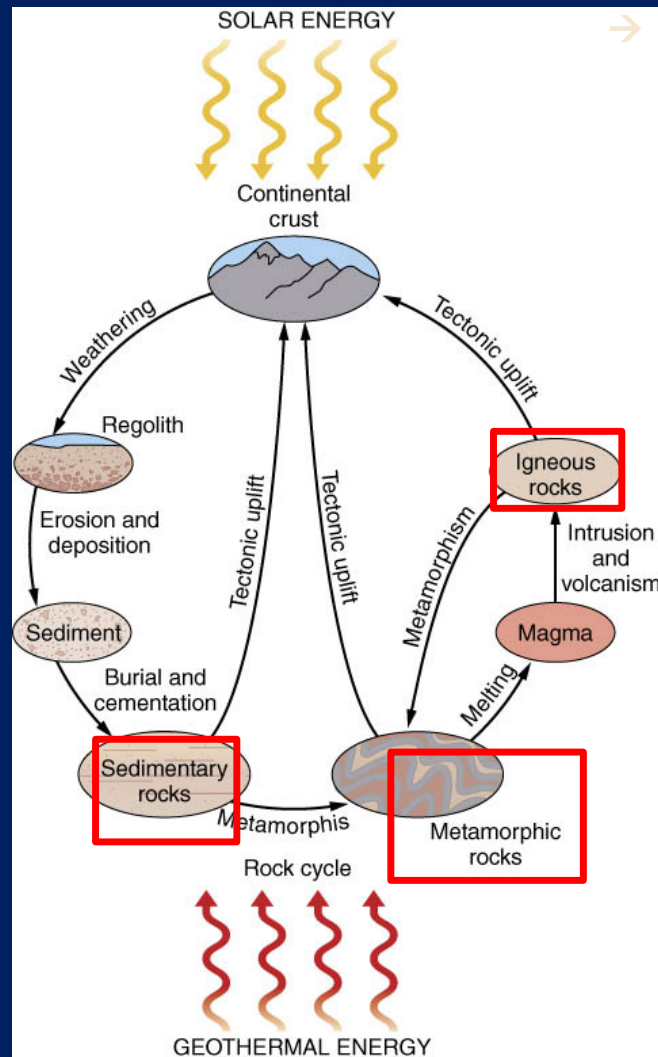
Sedimentary Rocks:

- burial & compaction of transported matter (sediment)

Metamorphic Rocks:

- alteration of preexisting rocks due to increased pressure & temperature

Geologic Time Scale

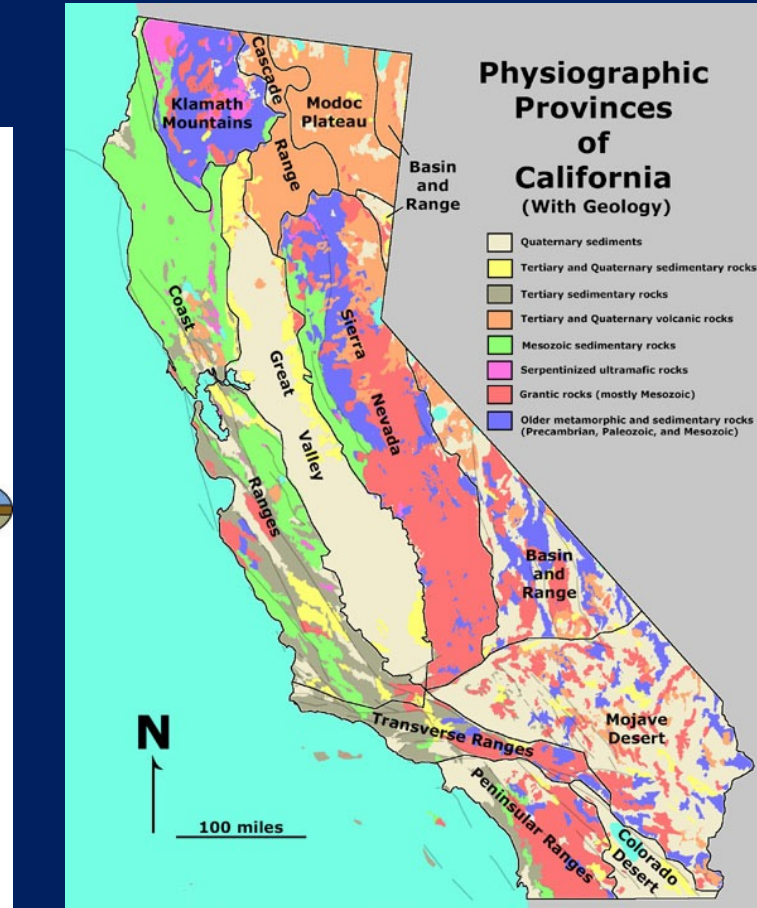
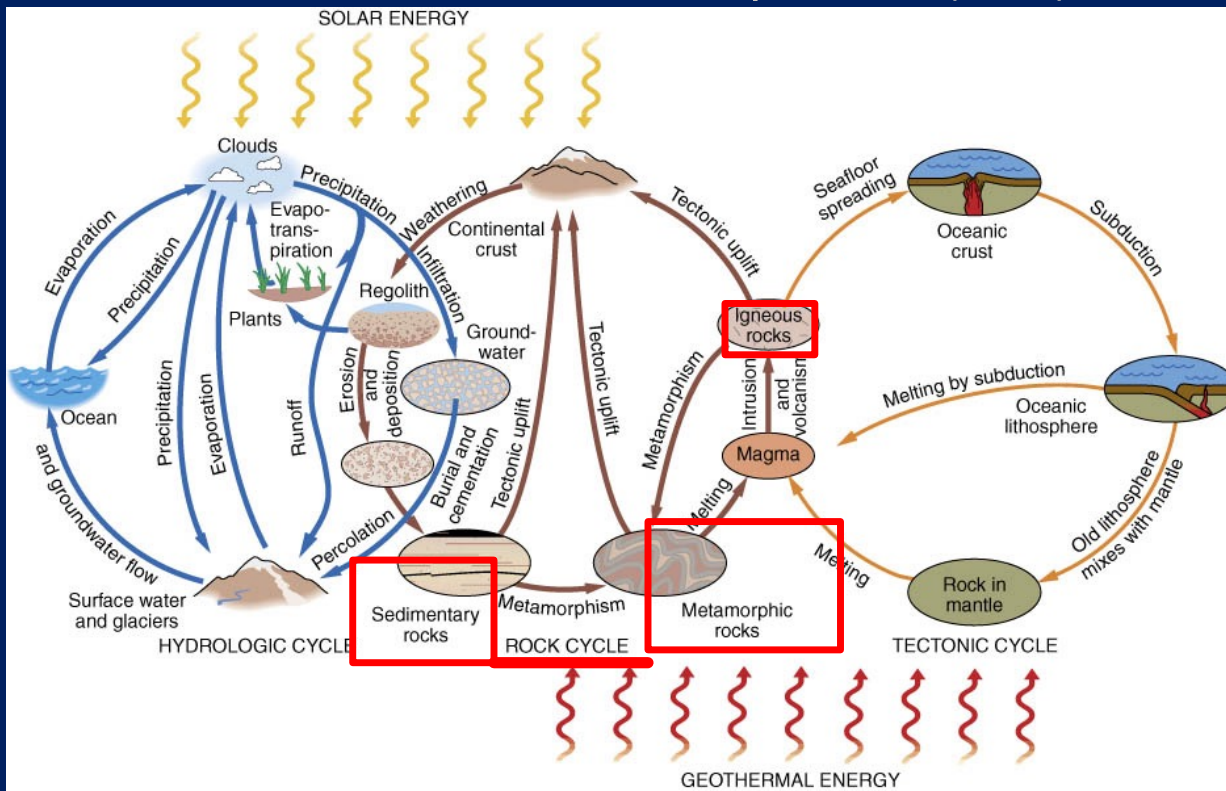


EON	ERA	PERIOD	EPOCH	Ma		
Phanerozoic	Cenozoic	Quaternary	Holocene		0.01 -	
			Pleistocene		Late 0.8 -	
		Tertiary	Neogene	Pliocene		Early 1.8 -
				Miocene		Late 3.6 -
				Oligocene		Early 5.3 -
				Eocene		Late 11.2 -
				Paleocene		Middle 16.4 -
			Paleogene	Oligocene		Early 33.7 -
				Eocene		Late 28.5 -
				Paleocene		Early 33.7 -
				Eocene		Middle 41.3 -
				Paleocene		Early 49.0 -
		Mesozoic	Cretaceous	Late		54.8 -
				Early		65.0 -
	Jurassic		Late		99.0 -	
			Middle		144 -	
	Triassic		Early		159 -	
			Late		180 -	
	Paleozoic		Permian	Middle		206 -
				Early		227 -
			Pennsylvanian	Late		242 -
				Early		248 -
			Mississippian	Late		256 -
				Early		290 -
			Devonian	Late		323 -
				Middle		354 -
		Early		370 -		
		Late		391 -		
Silurian	Late		417 -			
	Early		423 -			
Ordovician	Late		443 -			
	Middle		458 -			
Cambrian	Early		470 -			
	D		490 -			
	C		500 -			
	B		512 -			
	A		520 -			
Precambrian	Proterozoic	Late		543 -		
		Middle		900 -		
		Early		1600 -		
	Archean	Late		2500 -		
		Middle		3000 -		
Early		3400 -				
				3800?		

ROCKS RECORD EARTH HISTORY & CLIMATE EVOLUTION

Pepperwood Rocks:

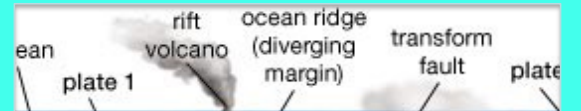
- Mesozoic-Early Cenozoic Franciscan Complex/mélange (ign., sed., met.)
- Sonoma Volcanics (ign.)
- Late Cenozoic marine & river deposition (sed.)



TECTONICS: CRUST FORMATION

- **Divergence:** spreading & melting
- **Convergence:** crumpling & erupting
 - ~180-80Ma Sierra Nevada granite/diorite
 - ~180-42Ma Ocean-Continent subduction
 - Accretionary wedge=Franciscan Complex
- **Transform:** sliding & smearing

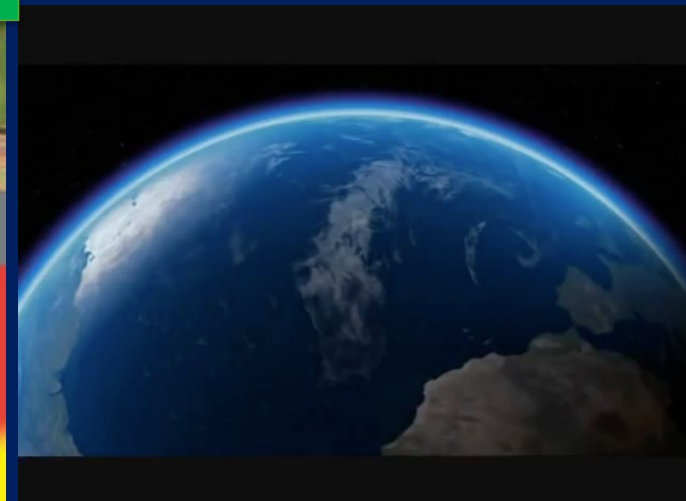
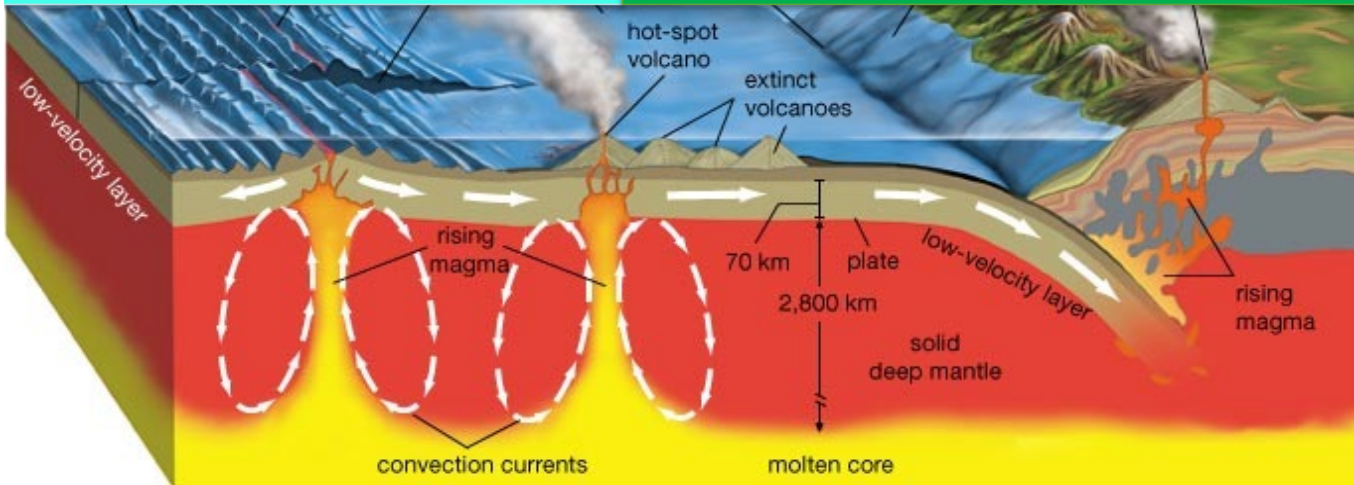
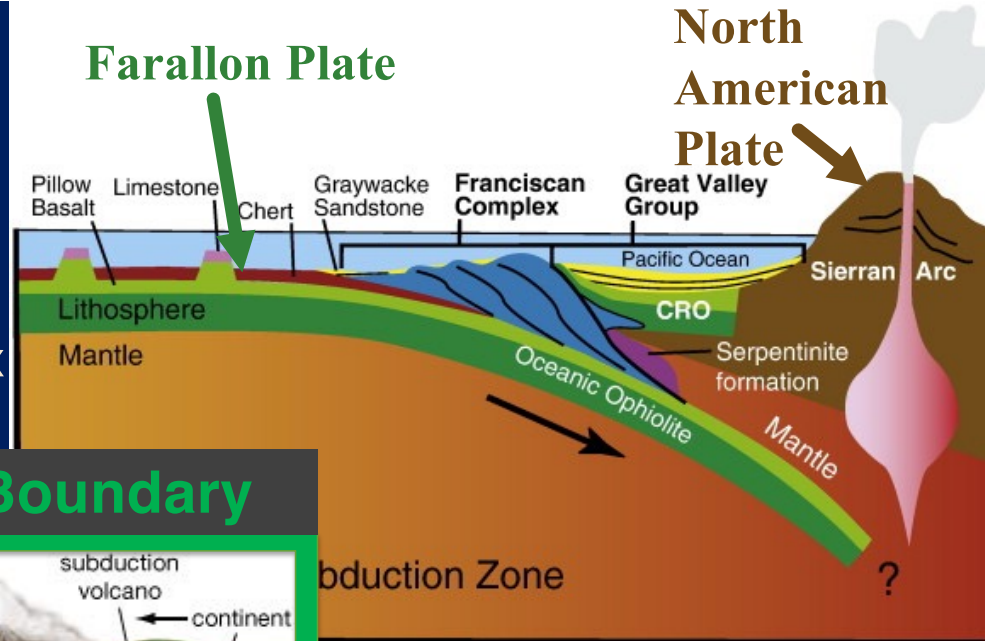
Divergent Boundary



Convergent Boundary



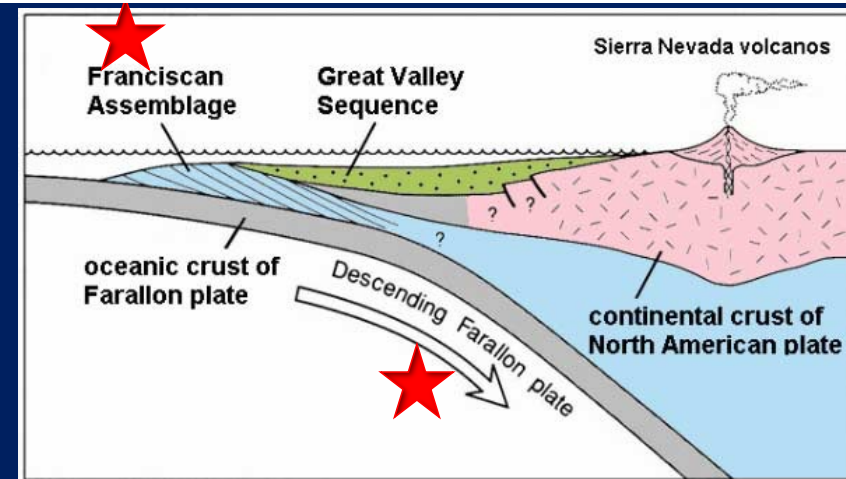
Farallon Plate



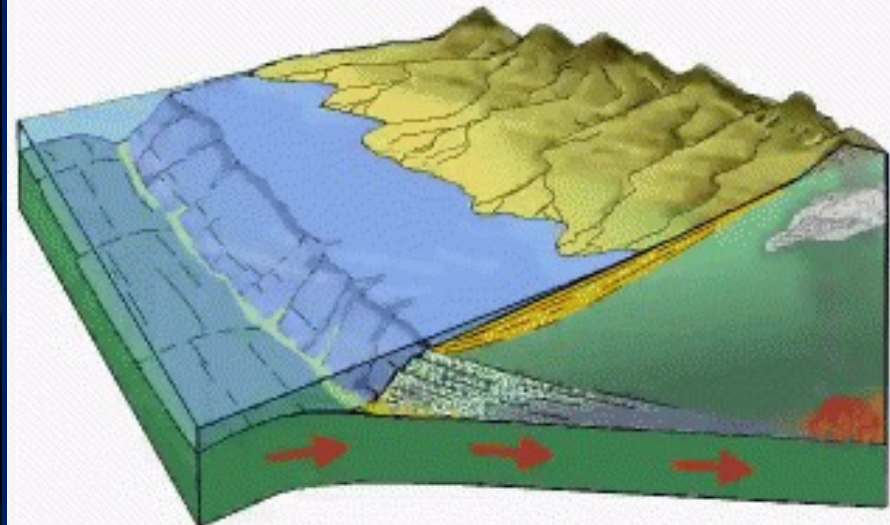
FRANCISCAN COMPLEX

Cretaceous Period CA Volcanic Arc/Subduction:

- Metamorphic & sedimentary & igneous rocks
- Magma chambers 25-40km deep → stratovolcanos → batholith (granite/diorite)
- Subduction trench accretionary wedge → Franciscan Complex



https://www.youtube.com/watch?v=ryrXAGY1dmE&ab_channel=GeoDharma

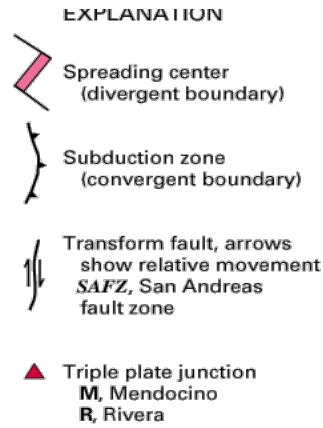
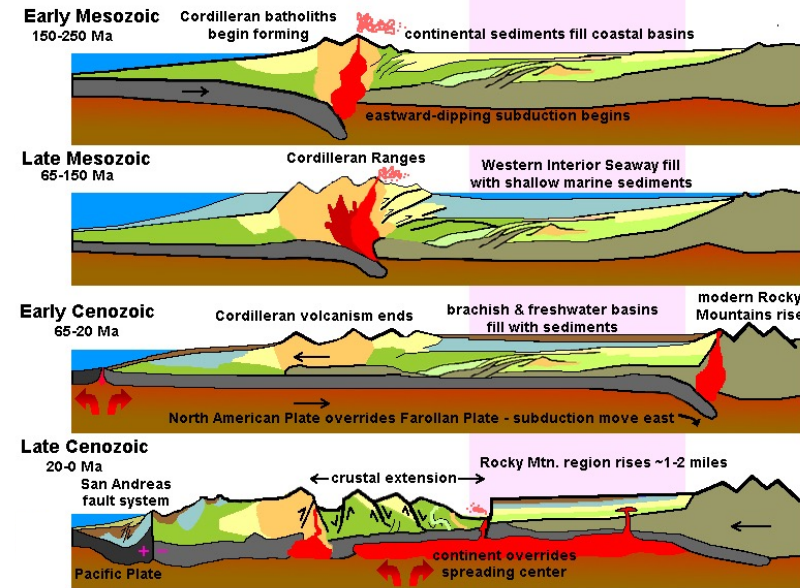
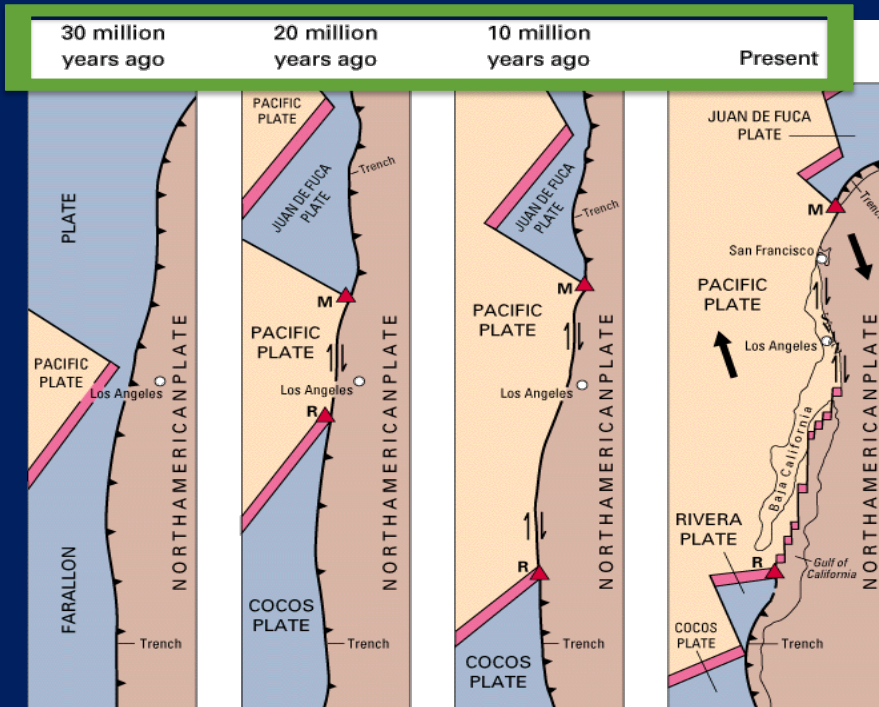


MAKE GIFS AT GIFSOUP.COM

FORMATION OF THE SAN ANDREAS

- Transform Boundary = right lateral fault system
- ~30-0 Mya Coast Range uplift & translation
 - Transition from subduction → uplift
 - Formed faults, volcanoes, valleys, mtns., rivers
 - Deep oceans → shallow oceans → river valleys

San Andreas Fault = 2-5cm/yr avg. rate of motion & ~315km total displacement



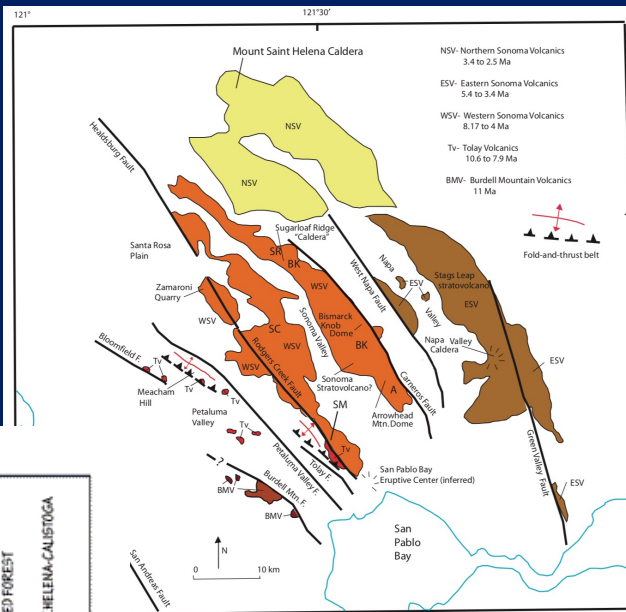
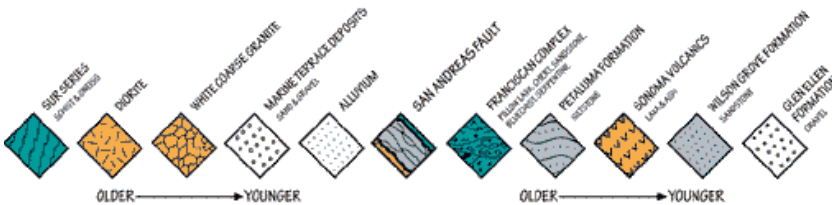
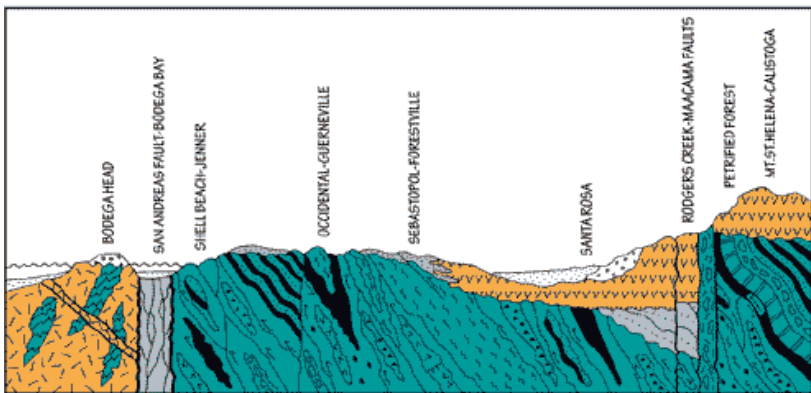
TRANSFORM BOUNDARY VOLCANISM

• Hypothesis: NW migration of slab window

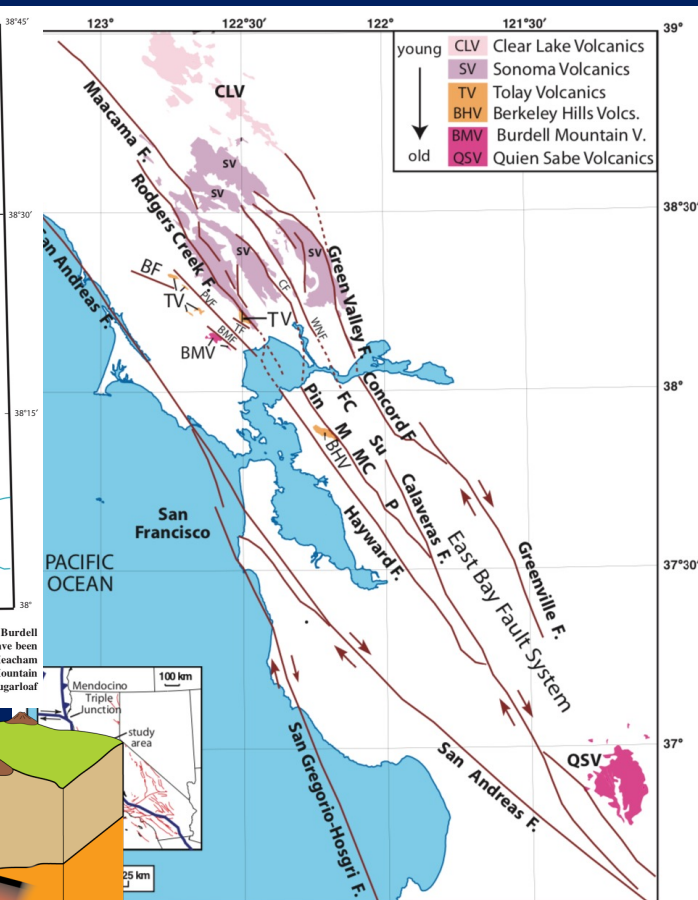
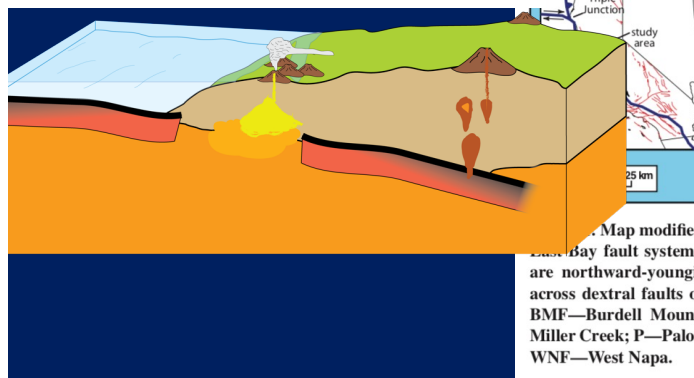
Volcanics Rocks/Regions:

- ~8.17-2.5Ma Sonoma Volc.
- ~2-0.01Ma Clear Lake Volcanic Area

SONOMA COUNTY GEOLOGY



volcanic fields, eruptive centers discussed in the text, and major faults north of San Pablo Bay. The Burdell volcanics have been correlated across faults of the East Bay fault system (Fig. 1). The Sonoma Volcanics have been divided into the western age group (WSV), the eastern age group (ESV), and the northern age group (NSV). The Sears Point-Meacham is also shown. Locations of stratigraphic columns in the western Sonoma Volcanics: SM—Sonoma Mountain assemblage; A—Arrowhead Mountain assemblage; BK—Bismarck Knob assemblage; SR—Sugarloaf

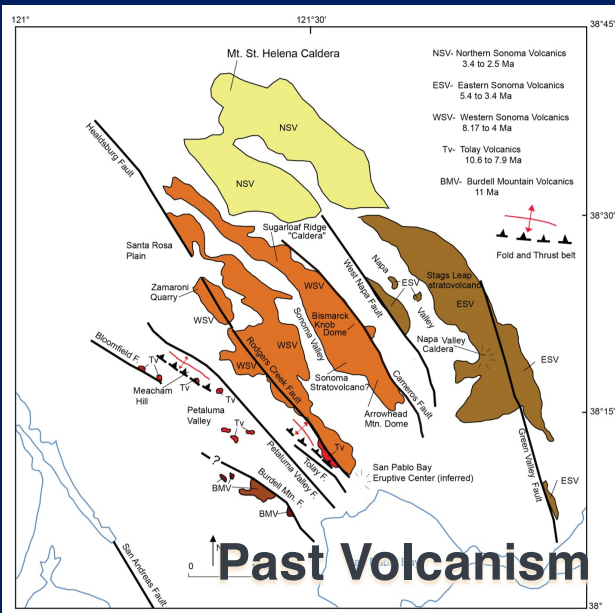
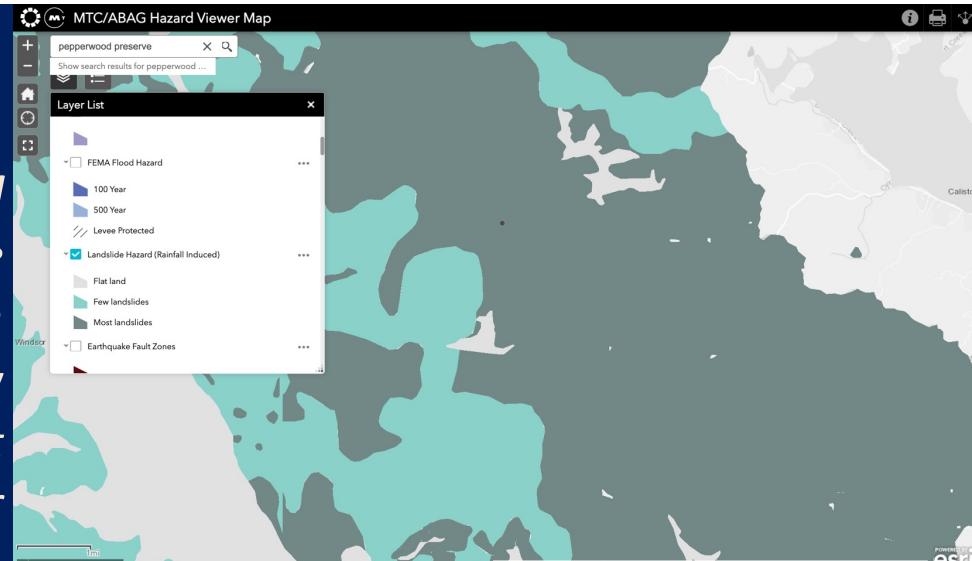


Map modified from Langenheim et al. (2010) showing the study area, faults of the East Bay fault system, and their possible extensions north of San Pablo Bay. Also shown are northward-younging Cenozoic volcanic fields, some of which have been correlated across dextral faults of the East Bay fault system. Fault abbreviations: BF—Bloomfield; BMF—Burdell Mountain; FC—Franklin Canyon; CF—Carneros; M—Moraga; MC—Miller Creek; P—Palomares; PVF—Petaluma Valley; Pin—Pinole; Su—Sunol; TF—Tolay; WNF—West Napa.

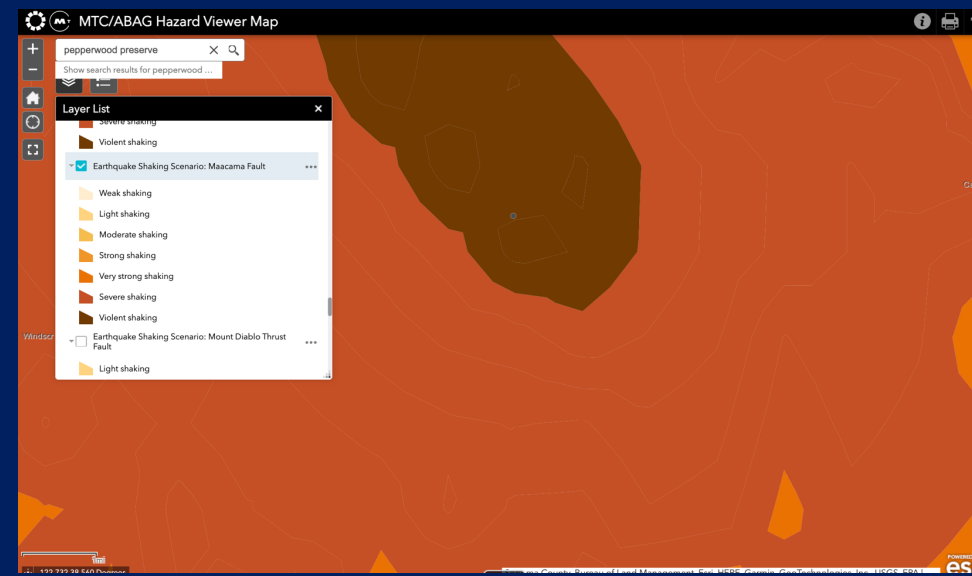
PEPPERWOOD GEOLOGIC HAZARDS

Pepperwood is located on the Maacama Fault + subject to heavy rains and wildfires

Local rainfall induced landslide map from Association of Bay Area Government Hazard Viewer



Maacama Fault earthquake shake map from Association of Bay Area Government Hazard Viewer



SOIL REFLECTS GEOLOGY & BIOLOGY

- Soil is interdisciplinary: biol-, geol-, meteor-, hydr-ology
- Soil is composed of:
 - (1) Parent minerals (rocks), (2) new minerals created in the soil, (3) water + air, (4) decayed organic matter, (5) living plants & animals
- Residual Soil: forms in place (from rocks beneath)
 - Mountain soil forms from underlying rocks
- Depositional Soil: lower elevation accumulation

Report — Map Unit Description

Sonoma County, California
CcA—Clear Lake clay, 0 to 2 percent slopes

Map Unit Setting
 Elevation: 20 to 1,500 feet
 Mean annual precipitation: 10 to 35 inches
 Mean annual air temperature: 57 to 63 degrees F
 Frost-free period: 225 to 300 days

Map Unit Composition
 Clear lake and similar soils: 85 percent
 Minor components: 15 percent

Description of Clear Lake Setting
 Landform: Basin floors
 Landform position (two-dimensional): Toeslope
 Landform position (three-dimensional): Tread
 Down-slope shape: Linear
 Across-slope shape: Linear
 Parent material: Alluvium derived from sedimentary rock

Properties and qualities
 Slope: 0 to 2 percent
 Depth to restrictive feature: More than 80 inches
 Drainage class: Poorly drained
 Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
 Depth to water table: More than 80 inches
 Frequency of ponding: None
 Calcium carbonate, maximum content: 5 percent
 Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
 Available water capacity: Moderate (about 9.0 inches)

Interpretive groups
 Farmland classification: Prime farmland if irrigated and drained
 Land capability classification (irrigated): 2e
 Land capability (nonirrigated): 3e
 Hydrologic Soil Group: C

Typical profile
 0 to 39 inches: Clay
 39 to 60 inches: Clay

Minor Components

Keys
 Percent of map unit: 5 percent
 Landform: Salt marshes

Whicht
 Percent of map unit: 5 percent

Haire
 Percent of map unit: 5 percent

Soil formation factors: CLORPT

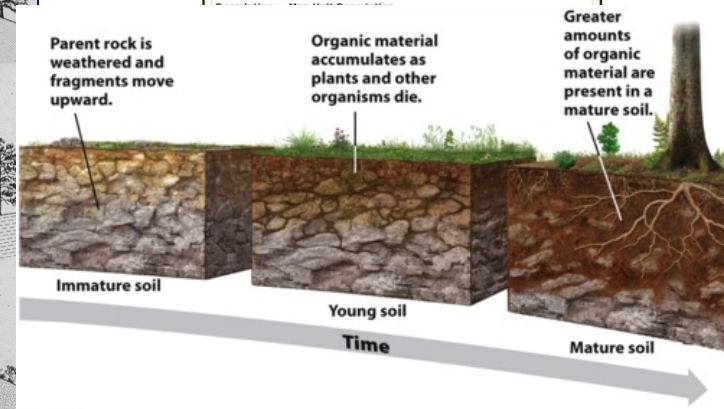
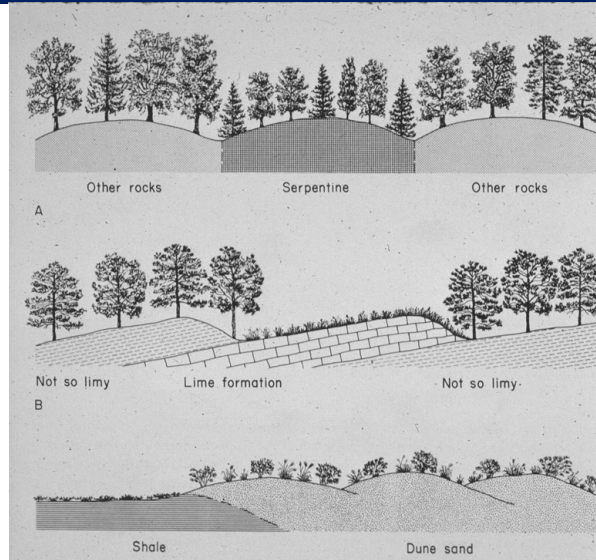


Figure 8.20
 Environmental Science
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