Geologic Timeline of Cliff Camp

History of the Universe:

Years ago	Years after BB	Event
13.8 Ga	0	Big Bang
13.7	100 Ma	First stars form (only hydrogen and a little helium)
13.6	200	First neutron star mergers
13.3	500	First galaxies form
12.8	1 Ga	Milky Way coalesces
11.8	2	Local supernovas and mergers begin to create higher elements
?	?	A local Supernova occurs that creates the molecular cloud of higher elements that formed into our Earth and our bodies.
4.6 Ba	9.2	Our Solar System coalesces

Earth's Geologic Timeline:

Period/Epoch	Years ago	Event	Tectonic Plates	Southern Sierra Nevada	Life
Hadean Eon	4.5-4.0 Ga	Hadean Eon Earth Coalesces and differentiates	none		
	4.4 Ga	Moon is created by Mars-sized collision			
Archean Eon	4.0-2.5 Ga	Archean Eon, Hadean ends First life- prokaryotes			cells w/o nucleus
Proterozoic Eon	2.5 Ga - 540 Ma	Proterozoic Eon, Archean Eon ends First Eukaryotes	Columbia assembled, broke up and reassembled into Rodinia		cells with nuclei, bacteria and blue-green algae
Phanerozoic Eon	540 Ma	Current Eon begins, Proterozoic ends. – Multicellular Animals and Plants			Multicellular life

Paleozoic Era	540-252	Paleozoic Era, end of Proterozoic Eon	Rodinia splits up into Laurentia (NAmer) and Gondwana. Laurentia sits astride the equator		"Ancient Life"
Cambrian Period	540-490		Warm shallow seas		Explosion of species
Ordovician Period	485-444		Almost all of NAmer was flooded, high CO2 levels		Marine life
	444	Ordovician Extinction (first)			85% of species lost
Silurian Period	444-420				Vascular plants & invertibrates
Devonian Period	420-360			Goddard Terrain – Paleozoic marine and volcanic deposits	Amphibians
	360	Devonian Extinction (second)			70% of species lost
Carboniferous Period	360-300				Seeds and eggs
	335		Pangea is fully assembled		
Permian Period	300-252			NAmer plate ends where Sierra Crest will be later	Rapid development of insects
	252	Permian-Triassic Extinction (third)			70% of species lost
	252-66	Mesozoic Era, end of Paleozoic Era			
Triassic Period	252-201		Pangea begins to breakup. Sea levels rise, shallow seas, warming climate, no polar ice		Age of Reptiles
	201	Triassic-Jurassic Extinction (fourth)		Most of California is a shallow sea	70% of species lost
Jurassic Period	201-145		Pangea continues to breakup into Laurasia (NAmer) and Gondwana..	Mesozoic Marine deposits of sand, mud, and lime (coral)	T.Rex, Stegosaurus, Pterosaurs, Brontosaurus

	200-80	Nevadan Orogeny Farallon plate subducts under NAmer plate. Surficial material was scrapped off and tacked onto NAmer plate. The rest plunged downward to melt and bubble up.		Granitic Plutons cool under at least 1000 ft of marine deposits that metamorphose into schist, quartzite, felsite and marble.	
	175		Laurasia and Gondwana are now completely separate and are beginning to break up into present day continents..	Kings Terrain - Erosion creates Mesozoic Marine Deposits of sand, mud, and limestone	
Cretaceous Period	145-66		Sea level at its highest level (up to 800 ft higher than today)		Triceratops and plesiosaurs show up
	80	The Farallon Plate is completely swallowed under the NAmer plate. The Pacific Plate butts directly against NAmer plate. Both plates are moving NW with the Pacific plate moving a little faster.	The San Andreas Fault Zone marks this unique boundary. It is the largest Transform fault in the world.	Extensive erosion washes almost all of the overburden into what is now the Great Valley.	
	66	K-T Extinction (fifth) Cenozoic Era begins (current era), Mesozoic Era ends	Chicxulub asteroid impact		Dinosaurs disappear
Paleocene Epoch	66-56				Rise of Mammals Rodents, marsupials and primates
Eocene Epoch	56-34				Horses, whales, birds
Oligocene Epoch	34-23	Temperate grasslands			Mastodons
Miocene Epoch	23-5				Dogs, bears, deer, saber-toothed cat, apes

	20-10			Volcanoes in the foothills erupt and fill stream channels often burying gold that had washed into them.	
	10-5	Tectonic tension pulls the Pacific Plate away from the NAmer Plate. This tension creates the Basin and Range provinces across the western half of America.	The Sierra is pulled from the rest of the NAmer plate, raised upward, and tilted dramatically westward.	The Owens Valley block drops downward to fill the gap created by the tension	
Pliocene Epoch	5-2	Cooler and drier			Australopithicus
	3			Volcanoes scattered about the High Sierra open vents and spew basalt.	
Quaternary Period	2.6	Current Period begins			
Pleistocene Epoch	2.6 Ma-12 Ka	"The Great Ice Age"	The present day 7 continental plates and 5 oceanic plates were close to their present positions. Sea levels rapidly change as glacial cycles wax and wane.		
	1.8 Ma-12 Ka	8 Glacial cycles			Mammoths and mastodons
	600 Ka	First Humans in Africa			
	400 Ka	First Neandertals			
	300 Ka	First Homo Sapiens			
	110 Ka	Last Glacial Period (LGP)		Glaciers carve and sculp the newly bared granite of the Sierra Nevada.	Yosemite and Tehipite carved by glaciers
	70 Ka	**Tahoe Max**-Sierran glacial maximum			
	30 Ka	First humans in NAmer. (Clovis Culture)			

	21 Ka	**Tioga Max**-Sierran glacial maximum			Mammoths, mastodons, and horses
Holocene Epoch	12 Ka	Current Epoch and interglacial period	The unloading of massive ice-sheets causes rebounding uplift of mountain chains	The Sierra is still rising about 20 to 30 inches per century and erosion continues to accelerate.	
	11.7 Ka	First humans in California			
	11 Ka	Holocene Extinction (sixth) mammoths, mastodons, horses, camels, and sloths in NAmer.			
	400 a	Columbian Era begins Arrival of Europeans		Yokut Indians of the Great Valley are subjugated. Mono Indian Culture of Sierra somewhat.	
Period/Epoch	Years ago	Event	Tectonic Plates	Southern Sierra Nevada	Life

Ga = Billions of years ago, Ma = Millions of years ago, Ka = thousands of years ago
Eons, Eras, Periods, Epochs, and Ages

Descriptive History:

About 300 Ma, NAmer plate was made up of much older Precambrian granites and sediment. The plate ended about where the Sierra Crest is now. Up until 150 Ma, most of California was a shallow sea and Paleozoic marine sediments were being deposited on what was then sea floor.

From about 200 Ma to about 80 Ma, what was to become California was involved in a great subduction zone where the much smaller oceanic plate (Farallon Plate) was being squeezed between the Pacific Plate and the NAmer Plate. The eastern edge of the Farallon was pushed down under the NAmer Plate. Some of this subducted material was scrapped off and tacked onto the leading edge of the NAmer Plate. The rest was forced down until it melted and bubbled upward as plutons of granitic magma into the overlaying sedimentary rocks.

From 200 to 150 Ma, California covered in a shallow sea. Mesozoic marine deposits of sand, mud, and lime (coral) built up where the Great Valley and the Sierra will later be.

About 100 Ma, the granite at Cliff Camp (Dinkey Creek Pluton) first cooled and crystallized under at least 1000 ft of overlying sedimentary rock. This sediment had started off as sand, mud, and lime, it hardened into shale, sandstone, and limestone. However, with the intense temperatures of the granite intrusions it was strongly metamorphized into schist, quartzite, felsite and marble.

Over the next 15 million years the Dinkey Creek Pluton was followed by the Mount Givens Pluton to the North and East, the McKinley Grove Pluton to the West and the Brush Canyon Pluton to the South.

About 80 Ma, the NAmer plate completed overriding the Farallon Plate and the Pacific Plate was then butted directly against the NAmer Plate ending the subduction and generation of granite. Both Plates are now moving in the same NW direction, but the Pacific Plate is a little faster. This has given rise to the unique San Andreas fault zone which now marks the boundary between these two plates.

About 80 Ma, most of the western edge of the NAmer plate now rose high above the ocean. It underwent extensive weathering and erosion until 60 Ma when it was only low rolling foothills with granite exposed in places.

About 20 to 10 Ma tension at the boundary of the Pacific and NAmer plate and Sierra volcanoes erupted into old stream channels often burying gold that had washed into them.

About 10 to 5 Ma the tension escalated and created the Basin and Range provinces across the western half of America as well as the Owens Valley Graben and the tilted block of the Sierra Nevada. The entire block of Sierra Nevada was pulled away from the older original boundary of the NAmer plate dropping a block of rock (the Owens Valley) downward to fill the gap and then tilting dramatically westward. Most of the country rock above the granitic plutons was eroded and deposited into the Great Valley except for scattered roof pendant like the nearby marble of Kings Caverns.

About 3 Ma volcanoes open vents and spew basalt in scattered locations throughout the Sierra. Lava Mtn near the pond is an example.

From about 110 to 20 Ka the Last Glacial Period extensive glaciers carved and sculpted the newly bared granite of the Sierra Nevada. Only scattered patches (known as roof pendants) of the Paleocene and Mesozoic metamorphic remain. Once the heavy ice sheets melted, the unloaded Sierra began rising. It is still rising about 20 to 30 inches per century and erosion continues to accelerate. Mastodons, Mammoths, horses, camels, and sloths abound.

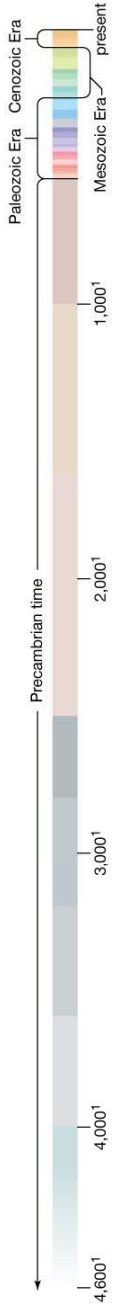
About 12 Ka, the first humans show up.

The "Western Mono bands" in the western southern Sierra Nevada foothills in the San Joaquin Valley: San Joaquin River, Kings River and Kaweah River (in today's counties of Madera, Fresno and Tulare) lived mostly as typical semi-nomadic hunters and gatherers of fishing, hunting and gathering as well as agriculture. In the winter, several families descended into the river valleys and built together fixed settlements, most of which were used for several years. In summer the winter settlements were abandoned and the family groups migrated as hunters and gatherers to the more sheltered and cooler altitudes of the mountains.
The tribal areas of the "Western Mono" bordered the (mostly) hostile Southern Sierra Miwok in the north, the "Eastern Mono" settled in the east, the Tübatulabal in the southeast and the Foothill Yokuts in the west.

Local Tribes

- Mono: Southern Sierra, West of Crest to foothills, From Fresno River to Tule River.
- Yokut: Great Valley
- Miwok: Central Sierra especially Yosemite
- Paiute: East of Sierra crest, Owens Valley
- Tubatulabal: South to Bakersfield
- Salinan: Central Coast, coastal range
- Chumash: Santa Barbara inland

Geologic time scale



Eonothem/ Eon	Erathem/ Era	System/ Period	Series/ Epoch	Stage/ Age	mya[1]
Phanerozoic	Cenozoic	Quaternary	Holocene	Meghalayan	present – 0.0042
				Northgrippian	0.0042 – 0.0082
				Greenlandian	0.0082 – 0.0117
			Pleistocene	Upper	0.0117 – 0.129
				Chibanian	0.129 – 0.774
				Calabrian	0.774 – 1.8
				Gelasian	1.8 – 2.58
		Neogene	Pliocene	Piacenzian	2.58 – 3.6
				Zanclean	3.6 – 5.333
			Miocene	Messinian	5.333 – 7.246
				Tortonian	7.246 – 11.63
				Serravallian	11.63 – 13.82
				Langhian	13.82 – 15.97
				Burdigalian	15.97 – 20.44
				Aquitanian	20.44 – 23.03
		Paleogene	Oligocene	Chattian	23.03 – 27.82
				Rupelian	27.82 – 33.9
			Eocene	Priabonian	33.9 – 37.71
				Bartonian	37.71 – 41.2
				Lutetian	41.2 – 47.8
				Ypresian	47.8 – 56
			Paleocene	Thanetian	56 – 59.2
				Selandian	59.2 – 61.6
				Danian	61.6 – 66
	Mesozoic	Cretaceous	Upper	Maastrichtian	66 – 72.1 ± 0.2
				Campanian	72.1 ± 0.2 – 83.6 ± 0.2
				Santonian	83.6 ± 0.2 – 86.3 ± 0.5
				Coniacian	86.3 ± 0.5 – 89.8 ± 0.3
				Turonian	89.8 ± 0.3 – 93.9
				Cenomanian	93.9 – 100.5
			Lower	Albian	100.5 – ~113
				Aptian	~113 – ~121.4
				Barremian	~121.4 – ~129.4
				Hauterivian	~129.4 – ~132.6
				Valanginian	~132.6 – ~139.8
				Berriasian	~139.8 – ~145

Eonothem/ Eon	Erathem/ Era	System/ Period	Series/ Epoch		Stage/ Age	mya[1]
Phanerozoic	Mesozoic	Jurassic	Upper		Tithonian	~145 – 149.2 ± 0.7
					Kimmeridgian	149.2 ± 0.7 – 154.8 ± 0.8
					Oxfordian	154.8 ± 0.8 – 161.5 ± 1
			Middle		Callovian	161.5 ± 1 – 165.3 ± 1.1
					Bathonian	165.3 ± 1.1 – 168.2 ± 1.2
					Bajocian	168.2 ± 1.2 – 170.9 ± 0.8
					Aalenian	170.9 ± 0.8 – 174.7 ± 0.8
			Lower		Toarcian	174.7 ± 0.8 – 184.2 ± 0.3
					Pliensbachian	184.2 ± 0.3 – 192.9 ± 0.3
					Sinemurian	192.9 ± 0.3 – 199.5 ± 0.3
					Hettangian	199.5 ± 0.3 – 201.4 ± 0.2
		Triassic	Upper		Rhaetian	201.4 ± 0.2 – ~208.5
					Norian	~208.5 – ~227
					Carnian	~227 – ~237
			Middle		Ladinian	~237 – ~242
					Anisian	~242 – 247.2
			Lower		Olenekian	247.2 – 251.2
					Induan	251.2 – 251.902 ± 0.024
	Paleozoic	Permian	Lopingian		Changhsingian	251.902 ± 0.024 – 254.14 ± 0.07
					Wuchiapingian	254.14 ± 0.07 – 259.51 ± 0.21
			Guadalupian		Capitanian	259.51 ± 0.21 – 264.28 ± 0.16
					Wordian	264.28 ± 0.16 – 266.9 ± 0.4
					Roadian	266.9 ± 0.4 – 273.01 ± 0.14
			Cisuralian		Kungurian	273.01 ± 0.14 – 283.5 ± 0.6
					Artinskian	283.5 ± 0.6 – 290.1 ± 0.26
					Sakmarian	290.1 ± 0.26 – 293.52 ± 0.17
					Asselian	293.52 ± 0.17 – 298.9 ± 0.15
		Carboniferous	Pennsylvanian[2]	Upper	Gzhelian	298.9 ± 0.15 – 303.7 ± 0.1
					Kasimovian	303.7 ± 0.1 – 307 ± 0.1
				Middle	Moscovian	307 ± 0.1 – 315.2 ± 0.2
				Lower	Bashkirian	315.2 ± 0.2 – 323.2 ± 0.4
			Mississippian[2]	Upper	Serpukhovian	323.2 ± 0.4 – 330.9 ± 0.2
				Middle	Visean	330.9 ± 0.2 – 346.7 ± 0.4
				Lower	Tournaisian	346.7 ± 0.4 – 358.9 ± 0.4

Eonothem/ Eon	Erathem/ Era	System/ Period	Series/ Epoch	Stage/ Age	mya[1]
Phanerozoic	Paleozoic	Devonian	Upper	Famennian	358.9 ± 0.4 – 372.2 ± 1.6
				Frasnian	372.2 ± 1.6 – 382.7 ± 1.6
			Middle	Givetian	382.7 ± 1.6 – 387.7 ± 0.8
				Eifelian	387.7 ± 0.8 – 393.3 ± 1.2
			Lower	Emsian	393.3 ± 1.2 – 407.6 ± 2.6
				Pragian	407.6 ± 2.6 – 410.8 ± 2.8
				Lochkovian	410.8 ± 2.8 – 419.2 ± 3.2
		Silurian	Pridoli		419.2 ± 3.2 – 423 ± 2.3
			Ludlow	Ludfordian	423 ± 2.3 – 425.6 ± 0.9
				Gorstian	425.6 ± 0.9 – 427.4 ± 0.5
			Wenlock	Homerian	427.4 ± 0.5 – 430.5 ± 0.7
				Sheinwoodian	430.5 ± 0.7 – 433.4 ± 0.8
			Llandovery	Telychian	433.4 ± 0.8 – 438.5 ± 1.1
				Aeronian	438.5 ± 1.1 – 440.8 ± 1.2
				Rhuddanian	440.8 ± 1.2 – 443.8 ± 1.5
		Ordovician	Upper	Hirnantian	443.8 ± 1.5 – 445.2 ± 1.4
				Katian	445.2 ± 1.4 – 453 ± 0.7
				Sandbian	453 ± 0.7 – 458.4 ± 0.9
			Middle	Darriwilian	458.4 ± 0.9 – 467.3 ± 1.1
				Dapingian	467.3 ± 1.1 – 470 ± 1.4
			Lower	Floian	470 ± 1.4 – 477.7 ± 1.4
				Tremadocian	477.7 ± 1.4 – 485.4 ± 1.9
		Cambrian[3]	Furongian	Stage 10	~489.5
				Jiangshanian	~494
				Paibian	~497
			Miaolingian	Guzhangian	~500.5
				Drumian	~504.5
				Wuliuan	~509
			Series 2	Stage 4	~514
				Stage 3	~521
			Terreneuvian	Stage 2	~529
				Fortunian	538.8 ± 0.2

	Eonothem/ Eon	Erathem/ Era	System/ Period	mya[1]
Precambrian	Proterozoic	Neoproterozoic	Ediacaran	538.8 ± 0.2 – ~635
			Cryogenian	~635 – ~720
			Tonian	~720 – 1,000
		Mesoproterozoic	Stenian	1,000 – 1,200
			Ectasian	1,200 – 1,400
			Calymmian	1,400 – 1,600
		Paleoproterozoic	Statherian	1,600 – 1,800
			Orosirian	1,800 – 2,050
			Rhyacian	2,050 – 2,300
			Siderian	2,300 – 2,500
	Archean	Neoarchean		2,500 – 2,800
		Mesoarchean		2,800 – 3,200
		Paleoarchean		3,200 – 3,600
		Eoarchean		3,600 – 4,000
	Hadean[4]			4,000 – 4,567

[1] Millions of years ago.

[2] Both the Mississippian and Pennsylvanian time units are formally designated as subperiods within the Carboniferous Period.

[3] Several Cambrian unit age boundaries are informal and are awaiting ratified definitions.

[4] The Hadean Eon is an informal interval of geologic time.

Source: 2023 International Chronostratigraphic Chart produced by the ICS.