THIS PDF SHOWS EXCERPTS FROM TRIP 1

Trip 1 Route Map

Chapter 7

Trip 1

Salton Trough

Brawley to Desert Hot Springs

Starting Point:	United States Post Office, 401 Main St., Brawley, CA (32 58.736 115 32.042 -117 ft)
Ending Point:	Desert Hot Springs Library, 11691 West Drive, Desert Hot Springs, CA (33 57.780 116 30.625 1081 ft)
Total Distance:	118 miles
County(s)	Imperial & Riverside
Altitude Range:	1310 ft (Start -117 ft, End 1081 ft, Minimum -229 ft at the Salton Sea, Maximum 1081 ft at the Desert Hot Springs Library)
Road Conditions:	Pavement & good graded dirt.
Conveniences:	Gas and food plentiful in Brawley and north of the Salton Sea.
Weather:	Very hot in summer, mild in winter, often windy. Best done in winter when the air is clear.
7.5' Quads:	Brawley, Westmorland East, Obsidian Butte, Niland, Wister, Frink, Durmid, Salton, Mortmar, Mecca, Thermal Canyon, Indio, West Berdoo Canyon, Myoma, East Deception Canyon, Seven Palms Valley, Desert Hot Springs. NOTE: AO Quads are slightly different: they are (from SE to NW: Durmid, Salton, Mortmar, Mecca, Thermal Canyon, Indio, SW 1/4 Lost Horse Mt, Myoma, Seven Palms Valley, Desert Hot Springs.
Geomorphic Provinces:	Colorado Dessert
Side Trips:	Obsidian Butte (good graded dirt) Red Hill (good graded dirt) Painted Canyon, Mecca Hills (pavement, good graded dirt, some soft sand)

Summary and Highlights

Our route begins in the Brawley Seismic Zone, the most northerly spreading center of the Sea of Cortez. Here the plate boundary transitions from a NW trending transform fault to a SE trending rift zone. We drive north, roughly following the New River and Alamo River to the volcanic Salton Domes at the south end of the Salton Sea. Continuing north past several fields of mud volcanoes and mud pots in the geothermal field, we travel over some of the deepest sediments in the world to Bombay Beach. Just north of here in the Durmid Hills the San Andreas Fault proper begins, emerging from the sand and passing through Salt Creek and into the dramatically folded Mecca Hills. Here the fault begins a gradual westerly turn where stresses buildup and the plate boundary splits. The split occurs in the Indio Hills near Biskra Palms, one of many oases lined up along the fault. The *Banning Fault* to the south trends west through San Gorgonio Pass. The *Mission Creek strand of the San Andreas Fault* to the north slices WNW through the Coachella Valley Preserve in the Indio Hills and runs straight through Desert Hot Springs at the foot of the Transverse Ranges, the end of the trip. The sparse vegetation and clear air make this one of the most beautiful and revealing trips of the book.

Geological Setting

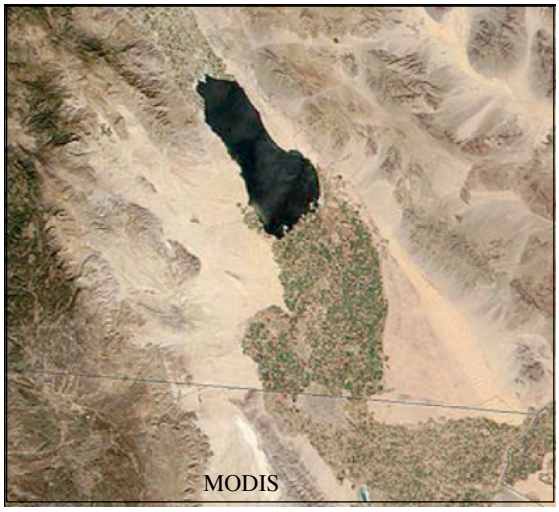
The Salton Trough is the largest area below sea level in the western hemisphere. Its 8,360 sq. miles is a closed, undrained basin that in pleistocene times was the northern extension of the Sea of Cortez. It is a roughly triangular area with an apex in the San Gorgonio Pass near Palm Springs. The trough broadens southward toward the Sea of Cortez and lies between the Peninsular Ranges to the west and the

Orocopio and Chocolate Mts to the east. To the south the trough spreads into Mexico to the Sea of Cortez. The Salton Trough is entirely within the Colorado Desert geomorphic province.

Except for the Salton Buttes and the occasional inselberg in the upward-turning foothills of the surrounding mountains, the Salton Trough is typical of lakebeds: flat and featureless. It is a broad, barren basin with little or no topographic relief. Wind and stream-borne sediments from adjacent mountains cover several miles of ancient deposits from the Colorado River. Many seasonal rivers supply water to the Salton Trough, the most important being the Whitewater River flowing southeast from the San Bernardino Mts, and the New and Alamo River that flow northward from Mexico.

Owing to the deep sediments, there is very little exposed rock in the trough. And what is exposed is found along the troughs margins and are relatively young, Pliocene or later. Motion along the fault and its ancient strands have juxtaposed rocks from as far away as Arizona and northern Mexico against those in the San Bernardino Mts, notably the Pelona Schist.

Salton Trough
with Mexican Border



MODIS

The San Andreas Fault is the major fault system in the northern trough. Just east of the Salton Sea near Durmid, the fault ends and is replaced by a right hand step to the Imperial Fault in the Brawley Seismic Zone. This structure represents the northern-most spreading center in a zig-zag series of divergent and transform faults that define a rift valley, the only one in the United States. As a result of spreading, the Salton Trough is sinking, in some places by as much as 1 - 2 inches per year. The subsidence takes place seismically and aseismically, i.e. during earthquakes and continuously over time.

The line of spreading centers is the plate boundary between the North American and Pacific Plates and reaches southward along the axis of the Sea of Cortex to the southern section of the East Pacific Rise just off the coast of Mazatan. North of Durmid the fault is a transform fault that strikes NXW before gradually turning westward through Indio and Desert Hot Spings. The left-hand turn is a restraining bend and is responsible - in its westward extension - for the stresses that raised the San Bernardino and San Jacinto Mountains.

Although the ancestral trough may have existed as long ago as 10 million years (Miocene), the modern structure developed as the Gulf of California began opening up around 5 million years. This was when the southern part of the East Pacific Rise was overridden by the North American Plate. Starting about 6 - 8 million years ago, the Colorado River flowed into the trough and deposited sediments from as far away as Wyoming and Colorado. During this time the trough represented the northern end of the Sea of Cortez. Later, as a Colorado river delta blocked the area, the region was isolated from the ocean. As it sank, terrestrial sediments accumulated.

The San Andreas Fault and its predesessor the Sand Hills - Algodones Fault define the eastern boundary of the trough. Both generally lie along the foothills of the Chocolate, Orocopia and Little San Bernardino Mts. To the west the trough is bounded by the San Jacino fault along the eastern base of the Transverse Ranges.

The trough is 200 miles long and 70 miles across at its widest where it meets the Gulf of California. Over four miles of sediment fill the basin. The depression stretches southeastward from the Palm Springs area into Mexico near Mexicali. Were it not for a 30 foot high ridge of Colorado River sediments SE of Mexicali near the Volcano Lake Levee, Palm Springs would be a saltwater fishing village on the Sea of Cortez.

JUMP TO ROAD LOG

Line of Palms along the Fault

Macomber Palms, Indio Hills

33 47.901 116 15.333 478 ft

Trip 1 Road Log

Trip 1 begins on the east side of park near the US Post Office in Brawley, CA. 401 Main St., CA (32 58.736 115 32.042 -117 ft). Gather at the Chamber of Commerce gazebo just east of the Post Office. Set odometer to zero.

miles *delta*

0.0 From the Brawley Post Office, circle behind the post office on the N. Plaza St (one way) and stay in the left hand lane. Then left (E) on Main St (CA-78).

0.5 *0.5* Turn left (NNE) on 8th St (CA-111). We are in the Brawley Seismic Zone, a spreading center in the Salton Trough that is the transition between the south end of the San Andreas Fault to the north and the Imperial Fault to the SW. The entire area of the Salton Trough is slowly sinking, in some places 1-2 inches per year. The land is typical of a former sea bottom, flat and featureless. As we drive north, we are gradually descending toward the Salton Sea. The sediments below us are some of the deepest in the world, 3-5 miles, much deeper than the Grand Canyon. If the sediments were suddenly removed, we would fall for about 2 minutes before reaching the basement rocks!

2.3 *1.8* Cross the New River, one of the two ancestral channels of the Colorado River that have occasionally filled the Salton Sea, most recently in 1905. The actual channels of the rivers are thought to have been cut in the 1840 flood of the Colorado River, though the area was certainly part of an earlier basin. The sediments here came from the Colorado River from as far north as Wyoming and began filling the trough when it first formed, about 5 million years ago in the Pleistocene. JUMP TO PAINTD CANYON SIDE TRIP

Side Trip to

Painted Canyon

Starting Point:	Jct Garfield St and 66th Ave (33 34.177 116 0.529 -15 ft)
Ending Point:	Jct Garfield St and 66th Ave (33 34.177 116 0.529 -15 ft)
Total Distance:	12.5 miles
Road Conditions:	Pavement, good graded dirt (except after heavy rain)
7.5' Quads:	Mecca, Mortmar, Cottonwood Basin

Mecca Hills are deeply-eroded sedimentary badlands north of the Salton Sea that are bounded on the west by the San Andreas Fault. Starting roughly two million years ago, a slight left hand bend (restraining bend) in the San Andreas Fault raised and distorted preexisting strata into the hills. Several parallel faults split the region including the Painted Canyon, Skeleton Canyon and Hidden Springs Faults. The original sediments were primarily lake and Colorado River deposits, later covered with alluvium as the uplifting hills eroded. During their elevation, the sediments were steeply tilted resulting in many dramatic arches and folds.

Approach to Painted Canyon

33 36.197 116 1.393 211 ft

Painted Canyon is a narrow, stream-cut gorge in the Mecca Hills. The rocks in Painted Canyon are largely Miocene, Pleistocene, Pliocene sandstone, siltstone and conglomerate whose clasts originate from older metamorphic gneisses, schists and granitic rocks from the nearby Orocopia and Little San Bernardino Mts. As we drive northeast up into Painted Canyon, we are driving down-section, i.e. into older rocks. We approach Painted Canyon from the SW on Quaternary sediments and the light gray Quaternary Ocotillo Conglomerate. The formation consists of light-grey to dark-green, coarse-grained sandstone and pebble, cobble, and boulder conglomerate that is weakly cemented. It was deposited as an alluvial fan on top of the Palm Springs Formation.

Painted Canyon Fault

Note car at lower left for scale
(33 36.925 115 59.963 592 ft)

As we cross the San Andreas Fault and enter the canyon, we encounter some prominent ridges draped with cinnamon-colored red clay gouge. The fault runs through skeleton Canyon and

marks the boundary between the Ocotillo Formation and the Palm Springs Formation. The Plio-Pleistocene Palm Springs Formation consists of lake, delta and alluvial deposits in the form of conglomerate, sandstone, and siltstone. Clasts are dominated by Orocopia schist, but gneisses and granitic debris from the Little San Bernardino Mountains are also present. A little farther up-canyon we enter the Miocene-Pliocene Mecca Formation. The Mecca Formation consists of reddish clays, sandstone, and gray conglomerate containing coarse angular clasts of granitic and gneissic debris. Gouge produced by the Painted Canyon Fault cuts through the Mecca Formation and produces a dramatic array of colors - pink, green, tan and grey.

Anticline & Syncline and Contact Zone

33 36.779 116 0.324 451 ft

It's important to recognize the many processes and periods through which the hills came into existence. The oldest clasts of granite and schists date back to Precambrian and Mezozoic times. These plutonic rocks were uplifted and exposed to weathering that broke them down into fragments. Gradually the debris was carried by rivers, rounding them into cobbles and pebbles. Along with Whitewater river sediments from the west and Colorado River sediments from as far away as Wyoming, the assemblage was mixed with sand and clay weathered from the Orocopio and Little San Bernardino Mts. The accumulation was compressed into conglomerates of sandstones and siltstones, the latter of which contain small fresh water fossils. Many layers of sediments were deposited, and then fairly recently, late Pliocene - even early Pleistocene, these were uplifted, rotated and fractured by the faults. Weathering of the hills carved deep canyons and cataclastic metamorphism along the faults produced gouge. Like many mountains, no single date can be attached to a given rock. Each has a long, broken history, generation after generation of change and transport. The process continues today.

Painted Canyon Side Trip Road Log

miles	*delta*	**Significant mile marks are noted on the map.**
0.0		Jct Garfield St and 66th Ave. Drive east on 66th Ave.
0.4	*0.4*	Cross the Coachella canal. 66th Ave gets renamed Box Canyon Rd.
1.0	*0.6*	Jct Box Canyon Rd and Painted Canyon Rd (dirt). Turn left (W) on Painted Canyon Rd. Note 4WD drive only sign. This overstates the concern. Except for some soft sand in the canyon, it's perfectly drivable in a 2WD with normal ground clearance, providing it has not rained recently.
2.1	*1.1*	Nice view to the right in the opening between the hills (Ocotillo Formation) that shows the red clay gouge, the tan Lower Palm Springs formation behind it and the darker Mecca Formation beyond that.
3.0	*0.9*	Road swings right (NE) toward the mouth of Painted Canyon. Note the color contrast in the hills approaching on the right, and the inselberg on the left.
3.6	*0.6*	Closest approach to the prominent ridge of red clay gouge 100 yds to the right and the inselberg on the left (33 36.197 116 1.393 211 ft). The San Andreas Fault parallels the ridge just to the east of the ridge. We will cross it a few feet ahead. It separates the Ocotillo Formation to the SW from the Palm Springs Formation to the NE.
4.0	*0.4*	Gentle arching anticlinal structure 100 yds on the left, with a small syncline at its NE end (33 36.440 116 1.116 308 ft).
4.6	*0.6*	Enter narrows in Palm Springs Formation (33 36.681 116 0.640 400 ft). Note the greenish interbedded layers of dark green siltstone and mudstone.
4.7	*0.1*	Emerge from narrows. Note the near vertical layers, indicating strong uplift and rotation. The darker Mecca Formation is clearly evident ahead and left.
4.8	*0.1*	Prominent fault on right.
4.9	*0.1*	Anticline and syncline in the Palm Springs Formation immediately left (NW) at 33 36.779 116 0.324 451 ft. A few yards further up-canyon (NE) from the anticline/syncline is an obvious fault separating the Palm Springs Formation and the darker Mecca Formation. Clasts in this region of the Mecca Formation tend to be larger and more densely distributed than those in the Palm Springs Formation.
5.2	*0.3*	Enter the narrows of the Mecca Formation. Upon emerging about 100 yards later, we see a colorful shattered mountainside of pink, green, gray and tan. This gougy material marks the beginning of the Painted Canyon Fault zone.