

A. View of Sutter Buttes RNC 249	Andesite and rhyolite domes - southernmost Cascades volcano?	39.166903, -122.149279
B. View of Castle Crags RNC 104	Granite intruded ?from underthrust Central Metamorphic belt into Trinity ophiolite complex	41.147584, -122.317538
I-5 cut 1 mi. n. of Castella cageol.kmz	Mapped as Devonian and Permian metavolcanic rocks. Mostly flows, breccia and tuff, including greenstone, diabase, and pillow lavas	41.151344, -122.303054
C. I-5 Dunsmuir Exit 729 Cut cageol.kmz	Mapped as Ordovician ultramafic rocks, mostly serpentine. Minor peridotite, gabbro, and diabase.	41.192998, -122.285503
Stewart Springs Pass L715	At the pass you will find a big parking area. Hike northwest on the PCT along the cirque wall. You should see lots of peridotite in the first half to 3/4 mile.	41.341956, -122.537813
A. Along Pacific Crest Trail NW of Stewart Springs Pass L715	Fresh dunite interbedded with peridotite. This is part of the Cambrian "Trinity peridotite" or "Trinity River block" of our abstract. These peridotites vary from dunite (all olivine) to harzburgite (olivine plus orthopyroxene) to lherzolite (olivine plus orthopyroxene plus clinopyroxene), and are locally feldspathic. The clinopyroxene appears as tiny bright green crystals of diopside. Look for small blebs of feldspathic material which represent late syntectonic pressure-release partial melt relicts. If you see any, they will cross cut the mantle tectonite fabric expressed by the pyroxenes, but will be smeared out along the late syntectonic fabric.	41.344617, -122.543658
Along Rail Creek Rd L715	You will find lots of (newly re-dated) Ordovician volcanic rocks and gabbro along this road, and a few exposures of fairly beat up peridotite. These are part of the Ordovician Trinity ophiolite, the "China Mountain block" of our abstract.	41.3856959, -122.6733398
B. Kangaroo Lake-slope above parking area L715	Kangaroo Lake is very pretty water-filled cirque carved into pegmatitic gabbros of the Supra-subduction zone ophiolitic complex, Siluro-Devonian age, the "SSZ ophiolite" of our abstract. These were very fluid-rich because they formed over a subducting slab which was dewatering; thus you get large crystals up to 20 cm or more. Grain size varies considerably, ...admire the modal banding. Most of the ophiolites I have actually visited have at least some pegmatitic gabbro, but the Trinity occurrences are especially striking and abundant. They intruded through the Trinity River and Scott River blocks, after the two were juxtaposed, and all these intrusions are surrounded by serpentinite.	41.333727, -122.640634
C. Slope above FS 41N03 1/2 mi. S. of Gazelle Summit L715	Walk up to the peridotite outcrops to see the serpentinitized and EXTREMELY deformed harzburgite of the "Scott River block". Don't look at fresh surfaces, they are serpentine, but if you look at the weathered surfaces you can see the difference between this rock and the fresh peridotite of the "Trinity River block".	41.432717, -122.635939
Along FS41N03	There is an abrupt turn south and you should see a patch of caliche	41.4243868, -

L715	above the turn, due to a cross fault. Then road 41N03 skirts along just above a series of glory holes and pits in serpentinite. Here the road is very close to being on a ductile shear zone between the Scott River and China Mountain blocks. House-sized boudins along the shear zone are below the road, but also some undeformed Ordovician gabbros. After a bit you come into a saddle and swing easterly through a bare zone that is serpentinite.	122.6138592
D. Saddle on FS41N03 21/2 miles S. of Gazelle Summit L715	Deformation within this Ordovician gabbro varies considerably; some is massive and nonfoliated, but elsewhere it is schistose or gneissic. We currently interpret the shear zone as an oceanic transform fault because it is intraoceanic and predates the Siluro-Devonian SSZ ophiolite. That environment would explain the variable deformation within the Ordovician gabbro.	41.413373, -122.60205
E. Horseshoe bend in Gazelle-Callahan Rd. L715	SW of Bonnet Rock you travel through mélangé with blocks of radiolarian chert, serpentinite, graywacke, limestone, etc., in a sheared scaly matrix. The best place to see this mélangé is on the east side of the bend, best viewed in afternoon light. As you ascend the steep hill around the bend you will pass upwards from the subduction complex into a nearly-undeformed trench slope basin occupied by siliceous shale with sparse turbidite graywacke beds. The contact grades from sheared mélangé into broken formation into gently deformed deep marine basin strata as you ascend to the pass.	41.447696, -122.64096
Bonnet Rock, viewed from Gazelle-Callahan Rd.- L715	It is lower Paleozoic limestone within mélangé of the Gregg Ranch Complex, a mid-Devonian subduction complex that was thrust over the Trinity Complex when the Forest Mountain terrane collided with the Yreka terrane in Early Devonian time.	41.514867, -122.574468
F. S. side of CA 3, E. of Forest Mtn Pass L715	Has a bronze plaque on a big blueschist knocker that commemorates the last stage coach robbery near the turn of the last century. The Forest Mountain terrane is a recrystallized peridotite associated with garnet-bearing amphibolite and metagabbro, serpentinitized only along its base, the west edge. Big knockers of Triassic blueschist are drifting down the hill from the Fort Jones terrane along the ridge. If you scrounge around in the forest below, you can collect some nice samples of blueschist. The peridotite here is very fresh.	41.678388, -122.721604
Slope viewed from CA 3 L715	As you drive up the hill on Highway 3 you can see large-scale banding of dunite and harzburgite on the ridges above the road.	41.668712, -122.72222
A. Loomis Museum NPS web site	Exhibits include photos from B.F Loomis who documented Lassen Peak's most recent eruption cycle and promoted the park's establishment. Additional exhibits include the original equipment Loomis used to document the eruptions and traditional Atsugewi basketry.	40.536485, -121.561927
B. Chaos Jumble, view of Chaos Crags	The Chaos Crags are a suite of five dacite domes that were emplaced over a period of about 100 years, beginning 1,100 years ago. Rockfall	40.541756, -121.543037

OLV 12 #6, FMW 93	avalanches travelled up to 4.5 km and formed the Chaos Jumbles.	
C. Hot Rock RNC 270	Huge block of andesite in the mudflow of 5/19/1915	40.534802, - 121.490772
D. Devastated Area OLV 12 #5, FMW 86	A swath of land that was swept by repeated debris avalanches, mudflows, and pyroclastic flows during Lassen Peak's 1915 eruptions.	40.515475, - 121.465173
E. View of Central Plateau	From the crest of the road you can look to the east across the Central Plateau, a region covered by young hybrid andesite lavas that have erupted during the past 0.30Ma, to the Prospect Peak and Mount Harkness basaltic shield volcanoes in the distance. OLV 12 #4	40.466597, - 121.439308
F. Cut east of Lake Helen RNC 271	Cliffs above Lake Helen and roadcuts east of it expose pale gray rhyolite inclusions in darker gray andesite, an apparent example of magma mixing.	40.470444, - 121.506585
Bumpass Hell Trail OLV 11	The first part of the 4 km trail to Bumpass Hell passes through the stage-three dacite of the Bumpass Mountain dome. Note the well-developed glacial striations and polish on the surface of the dome near the beginning of the trail. At the viewpoint 0.85 km from the parking lot, the trail crosses a contact between the Bumpass Mountain dacite and an underlying stage-two andesite.	40.465794, - 121.514434
G. Bumpass Hell OLV 11	Intense alteration of the host rocks is apparent in the development of the clay minerals seen in the boiling mudpots and the white outcrops just south of the boardwalk entrance.	40.457231, - 121.502027
H. Diamond Peak Overlook OLV 10 #2	Diamond Peak is a relatively unaltered sequence of andesitic lava flows and pyroclastic rocks that were deposited just east of the vent of the Brokeoff Volcano.	40.44456100 000001, - 121.519607
I. Sulphur Works OLG 10 #1b; LVRI 8, 24,25, 33	Small thermal area with fumaroles and boiling springs, thought to mark the approximate location of the vent of the Brokeoff Volcano. Impacts on road and boardwalk; algal mats just to south on Sulphur Creek.	40.44865, - 121.535624
J. Visitor Center OLV 10 #1a	View of stratified lavas and pyroclastics in Brokeoff Mountain, preserving a remnant of the flank of the Brokeoff Volcano	40.43663, - 121.533464
A. Lime Saddle K715 #1	Disrupted metamorphic rocks (includes Permian limestone blocks in Central Belt).	39.674895, - 121.557217
B. Cut on N. Side CA 70 near Parkhill K715 #2	Jarbo Gap "ophiolite" (Serpentinized peridotite with cross cutting mafic dikes).	39.726625, - 121.498499
C. Cherokee hydraulic mine K715 #3	Lovejoy olivine basalt (Miocene) capping Oroville Table Mountain and overlying Eocene auriferous gravels – inversion of relief. Cherokee hydraulic mine)	39.6004, - 121.584867
D. Lake Oroville shoreline NW of Tidwell Bar Bridge K715 #4	Sheeted dikes and Pillow basalt outcrops of Smartville complex (middle Jurassic)- Remnants of accreted island arc complex.	39.554431, - 121.434944
Cut on Bald Rock Rd K715 #5	Bald Rock Pluton [optional] (Cretaceous granodiorite intruding Central and Western Belt assemblages)	39.636959, - 121.345149
E. Cut on Marysville	A cross-section of sheeted dikes intruded into the overlying volcanic	39.342119, -

Rd S. of Collins Lake Rd. N412 7 #3	pyroclastics and flows (not shown at the outcrop). Multiple dike generations shown by chilled margin relationships, porphyritic texture in later dikes.	121.336674
F. Cut on CA 20 1/4 mi. E. of Marysville Rd. N412 8	Diabase, andesite, and dacite dikes cutting plagiogranite screens (lens-shaped fragments of plutonic rock), with myrmekite microstructure, and multi-textured gabbro. The screens are relics of gabbro, tonalite, and trondhjemite plutonic rocks or segregates thereof.	39.361744, - 121.319061
G. Cut on CA 20 1/2 mi. E of Yuba River near Smartville N412 7 #2; RHL 21	Greenish-black Jurassic pillow basalts exposed, with darker (finer crystalline) chilled margins of a pillow.	39.2162637, - 121.3290644
H. Empire Mine State Historic Site TSN 172	Mine structures, models and displays at largest of mines that operated 1851-1956 to vertical depth of more than 1 mile. Open 10-5.	39.207025, - 121.051265
I. Malakoff Diggins State Historic Park TSN 176, RHL 37	Malakoff Pit dug 600 feet deep by hydraulic mining of Eocene river gravel, now filled in to 300 ft. deep. North Bloomfield ghost town. Park open sunrise to sunset.	39.362717, - 120.924522
A. I-50 westbound Gold Run Rest Area TSN 168, RHL 49, 236	Mile-wide, 300 ft. thick Eocene river channel gravels, spectacularly exposed, mined 1860-1880. Short trail to Stewart Mine working face from e. end.	39.179, - 120.8555
B. Loch Leven trail RHL 52,. 236	Jurassic volcanic rocks grade over several hundred feet into Cretaceous Granite, 1/2 mile along trail from trailhead on Hampshire Rocks Rd.	39.3091926, - 120.5160169
C. Donner Pass RHL 55, 236	Back-to-back cirques on either side of Sierra divide, view of Donner Lake 1160 ft. below.	39.31646150 000001, - 120.3259245
View of China Wall RHL 58, 236	Wall built to support original transcontinental railroad visible.	39.316954, - 120.3194498
D. Quarry on NV 206, 2 mi. S. of Genoa RHL 87, 237	Slickenlines on exposed fault plane of Genoa fault, one of the best exposed active fault surfaces in US. Granite from golf ball to marble size, ground as if by millstones.	38.9854, - 119.8354
E. Conway Summit View of Mono Lake FMW 71	Turnout on 395 where Mono Lake is first visible	38.07403300 000001, - 119.176695
A. Convict Lake CLML, UDO 240	Walk through Cambrian through Permian strata of Mt. Morrison roof pendant, much of it contact-metamorphosed in 10-mile RT hike to Mildred Lake; moraines of three glaciations (pre-Tahoe, Tahoe, Tioga) visible on drive to lake.	37.594728, - 118.851992
B. McGee Creek Campground TSN 98; UDO 232	Hilton Creek fault has 50-foot high scarp that cuts a glacial moraine.	37.562408, - 118.785637
C. Cut on US 395 at Lower Rock Creek	Big Pumice cut allows dating of Sherwin Till at about 800K yrs; air-fall pumice from Long Valley eruption overlain by ash-fall pumice and	37.5558946, - 118.6571019

TSN 102; UDO 225	cut by clastic dikes.	
D. View of "pimple" gas vents along Gorge Rd. UY 242, TSN132	Tufa towers uncovered by lowering of Mono Lake due to water usage; boardwalk to water's edge.	37.47531, -118.564417
E. Owens River Gorge, viewpoint by gate to upper power plant TSN 138	Obsidian flow extending 1-2 miles from its vent, unusual, dated about 1320 CE	37.525244, -118.575263
F. Hot Creek Geological Site TSN 96	Hot Creek is antecedent stream that cut 100-foot deep gorge in the SE flank of the LV resurgent dome, exposing hot springs.	37.660515, -118.827719
A. Mono Basin Visitor Center UY 238	From parking area, look west to view of 13 KY old Lake Russell shoreline just beneath Lee Vining's "LV" letters. From patio, see Black Point, Negit Island, Paoha Island, mesa that is top of old delta, White Mts., and Mono Craters chain.	37.966484, -119.1207
B. Cut along Cemetery Rd. UY 250	Soft sediment deformation in basaltic tephra deposited in Lake Russell about 13 KY ago.	38.0239063, -119.1326576
Trailhead to Black Point UY 252	Trailhead for 1-mile to top of Black Point volcano, flat-topped because of eruption underwater, and cut by fissures up to 80 feet deep.	38.0258504, -119.0844157
C. Panum Crater UDO 292, TSN 137	Pumice rim, rhyolite core in center, with glass dome built in 3 steps. Gash in north rim caused by explosion. Erupted 1310 CE.	37.926906, -119.044462
D. South Tufa Area UY 242, TSN132	Tufa towers uncovered by lowering of Mono Lake due to water usage; boardwalk to water's edge.	37.942199, -119.028986
E. North Obsidian Coulee TSN 138	Obsidian flow extending 1-2 miles from its vent, unusual, dated about 1320 CE	37.911605, -118.997583
F. View from Log Cabin Mine Rd to Lee Vining Canyon UY260	Panoramic view of lower Lee Vining canyon showing Tioga and Tahoe moraines.	37.942679, -119.137754
G. Ellery Lake turnout along CA 120 TSN 270	Paleozoic dark metasedimentary rocks (hornfels)	37.935846, -119.234303
Bennettville trailhead UY 266	Park at end of Junction Lake Rd., walk across bridge toward campground, stay right before campground and follow Bennettville trail signs.	37.937135, -119.252041
H. Bennettville UY 268	Folded metasedimentary rocks with glacially polished surfaces, at failed silver mining ghost town, 0.3 mile hike from trailhead.	37.93548, -119.259387
I. Tioga Lake overlook TSN 268	View to SE up Glacier Canyon, cut into Miocene land surface preserved as Dana Plateau.	37.921316, -119.254712

J. Tloga Pass / Dana Meadows Viewpoint TSN 266; UY 255	Kettle ponds and recessional moraines in Dana Meadows.	37.910276, - 119.258126
A. Silver Lake TSN 130	Steep slope above is a fault scar cleaned off by the Rush Creek Glacier.	37.779509, - 119.128171
B. Devil's Punchbowl TSN 139	Small crater from eruption that quit early - no tuff ring as at Panum.	37.809628, - 119.028324
C. Obsidian Dome TSN 120, UDO 279	Formed when rhyolite magma oozed from a vent ca. 1350 CE. Black obsidian, plus rhyolite and pumice in abandoned quarry, 1/3 mi. walk up gated road.	37.7495374, - 119.0218332
Inyo Craters trailhead TSN 118	Follow unpaved road 1 mile to parking area.	37.689172, - 119.005622
D. Inyo Crater Lakes TSN 118	Hike 1/3 mile to two small craters containing lakes, formed when magma encountered groundwater ca. 1450 CE	37.691424, - 119.010934
E. "Earthquake Fault" ravine TSN 110; UDO 250	Crack 10 ft. wide, 50 feet deep, about a mile long, may have formed or widened in 1750 earthquake.	37.653826, - 118.999951
F. Minaret Summit TSN 116; UDO 271	View to W of Minarets, formed of Cretaceous metavolcanics, and forming range crest as distinct from drainage divide which is at Minaret Summit.	37.656699, - 119.061423
G. Devil's Postpile UDO 272, TSN 112	Columnar jointing in 400 ft. thick basalt flow, thick because of obstruction in valley, possibly glacial moraine..	37.627059, - 119.085045
H. Mammoth Mt. top of Gondola Ride UDO 258, TSN 106	Fumarole above Mid Chalet. View from 11,030 summit and northern viewpoint, across Long Valley Caldera.	37.622826, - 119.034653
I. Horseshoe Lake TSN 108, UDO 267	Area bare of vegetation due to CO2 release that began following 1989 earthquakes.	37.612994, - 119.019192
A. Pothole Dome UY 154, TSN 264	Glacial striations, polish, chatter marks, and potholes on roche moutonnee overlooking Tuolumne Meadows. Aplite dikes respond differently to glacial polish compared to granite. Half Dome granodiorite erratics (no megacrysts) rest on Cathedral Peak gd (megacrysts) in shallow bowl just S. of true summit. 3/4 mile loop to top of dome and return via steeper side.	37.879924, - 119.393214
B. Tenaya Lake UY 175, 167; TSN, 260	Treetops projecting from lake are evidence of megadrought between 1000 and 1400 CE. Exfoliation slabs across road. Erratics of Cathedral Peak Granodiorite (huge phenocrysts) rest on Half Dome gd.	37.836314, - 119.454375
C. Olmsted Point UY 166	Erratics at parking area are Half Dome Granodiorite resting on striated same, but hike 1/2 mile to Olmstead Point proper to see granodiorite of Kuna Crest on Half Dome gd.	37.8104445, - 119.4854197
D. Cut at bend in CA 120 W. of Yosemite Creek UY 149	Exfoliation joints thicken with depth	37.839551, - 119.590151
E. Cuts along Cherry	Corestones in Eocene erosion surface laterite show how weathering	37.828491, -

Lake Rd. 1 mi. N. of CA 120 UY 229	can produce rounded boulders in soil.	120.007868
F. Rim of the World Vista UY. 225	View of low-relief Eocene surface cut by young Tuolumne River gorge.	37.821908, -120.039234
G. Cut on CA 132 0.2 mi W. of Coulterville TSN 220	Massive white quartz veins cut green-colored quartz-ankerite-mariposite (chromium mica) rock. Outcrop lies on trace of Melones fault and Mother Lode. Mariposite forms from hydrothermally altered serpentine.	37.707981, -120.198026
H. View across Stanislaus River from Tulloch Road UY 219	Columnar-jointed latite of 10 my-old Stanislaus Table Mtn. lava flow overlies (covered) river gravels that rest on 175 my-old meta-volcanic breccia.	37.853204, -120.636234
View across Stanislaus River just downstream of Goodwin Dam UY 222	Clear view of latite resting on river gravel.	37.8604888000001, -120.6320018
A. Battery Godfrey Trail to Baker Beach B2188 68	Descend path through serpentinite to beach and melange containing sandstone,, chert, and garnet-bearing amphibolite	37.8029385, -122.4780485
B. Battery 129 Parking TSF 72, RHL 13	Folded red chert with red shale, resting on pillow basalt.	37.827493, -122.498945
C. Point Bonita lighthouse GGH 13 #2, TSF 74	Graywacke, pillow basalt with chert altered to jasper, along trail. Best pillows are near water line below lighthouse.	37.8219300000001, -122.529386
D. Quarry in red chert B2188 67 #3	Ribbon chert with shale and gray manganese staining near base.	37.832162, -122.528898
E. Headland at N. end Rodeo Beach TSF 76 #1, B2188 68 # 4	Graywacke with graded bedding and cross-bedding, excellent views.	37.832006, -122.541032
Rodeo Beach GGH 14, TSN 76 #2	Primarily rounded red and green chert, lesser mafic volcanic rock fragments 1-4 mm; also carnelians, semi-translucent orange chalcedony that formed in vesicles of pillow basalts.	37.8299125, -122.5367618
F. Outcrops S. end of Rodeo Beach TSF 77	The following rocks are encountered as you go southward along the cliff:1. red chert,2. sandstone and siltstone; repeated several times by faulting,3. mixed pillow basalt and chert,4. large sandstone blocks, probably from a landslide, 5. a promontory of pillow basalt that blocks further access to the south.	37.826287, -122.534604
G. Ring Mountain, end of Taylor Rd. TSF 94	Blocks at parking area include amphibolites, eclogites, and blueschists. The amphibolites have dark elongated crystals, sometimes up to two inches long. The blueschists appear as very	37.91296, -122.4880743

	dark blue layers within the schists. The eclogites have small red crystals of garnet.	
Ring Mountain summit TSF 97	1/4 mile hike to crest, formed of two thick sub-horizontal layers of light yellow-brown serpentine that resists weathering and forms hard blocky outcrops. On fresh exposures, the rock is pale green, sometimes with dark specks about the size of small peas. These dark specks are remnants of pyroxene crystals that have been altered to serpentine.	37.9098214, - 122.4861324
Twin Peaks TSF 66	North peak is red chert, south peak is weathered chunky, yellow-brown pillow basalt.	37.7524957, - 122.4475595
H. Mussel Rock Park TSF 114, B2188 92	Steep cliffs on NE side of San Andreas fault, composed of weakly consolidated Pliocene and Pleistocene sediment, view of offshore rock, SW of fault, of Franciscan metamorphics	37.6660452, - 122.4946355
I. Cuts along Devils Slide trail W. of Pedro Point parking SAF 92, TSF 121	Steeply dipping and folded layers of shale, sandstone, and calcareous marl of Paleocene age, in first 1/4 mile of hike from parking area.	37.5852753, - 122.5127503
Devils Slide SAF 92, TSF 122, B2188 116	Landslide where steeply dipping Paleocene strata slip on a glide plane as much as 150 feet below the surface on weathered granitic bedrock, extending from 900 feet elevation to sea level.	37.58230340 000001, - 122.5151324
J. Cuts along Devil's Slide trail N. of main parking area SAF 93, TSF 122	Cretaceous-age granitic rocks of the Salinian Block, crosscut by quartz-rich and mafic dikes, at location of slide of Paleocene turbidites from 900 feet elevation to sea level.	37.573078, - 122.51691
K. Point Montara SAF 95	Montara granitic rock in fault (and depositional?) contact with Quaternary marine terrace deposits.	37.537297, - 122.518914
View of San Andreas Lake off Skyline Blvd. SAF 83	Skyline Boulevard follows Buri Buri Ridge along the east side of the San Andreas Rift valley northward to Daly City. Look to the west to get a glimpse of San Andreas Reservoir, the original home of San Andreas Lake, a historic natural sag pond from which the name of the San Andreas Fault was derived.	37.61063, - 122.435498

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