Field Trip - San Mateo County -- 1 day.

On this field trip, we'll observe soils formed in a variety of environments across the San Francisco Peninsula in San Mateo County. This handout describes profiles for typical pedons of soils at several locations along the way; we'll observe as many properties as feasible given the site conditions. Though the causes are complex, we'll use the soil-forming-factor approach to make sense out of the variations. As we've discussed in class, the type of soils we find in a given location is the result of five (if not more) soil forming factors. Each of these factors is significant in the San Mateo County area, though parent material and relief are probably the source of most of the detailed variations.

Parent Material varies significantly, partly due to the tectonic history of the area. The most dominant geologic unit is the Franciscan Assemblage, a melange of sandstone, graywacke, shale, chert, and greenstone, frequently sheared and crushed from crustal movements. Variations in these rocks lead to variations in soil properties (e.g. texture, permeability, available moisture, and erodibility), with a few highly significant variants. Part of the mix is ***serpentinite***, a metamorphosed ultramafic rock; its soils support unique and often endemic species of plants (usually no trees), are high in clays, and tend to be quite thin with a lithic contact. West of the Pilarcitos fault (a branch of the San Andreas system), Montara Mountain granitics are significant; though granitic rocks tend to produce relatively thin soils on uplands under forest cover, these grass+ coastal scrub-vegetated soils can attain fairly respectable depths -- up to a meter (40") in places. In the coastal zone, we'll find that dune sands contrast with coastal terrace alluvium, and along the bay (where undeveloped) mudflats produce unique soil properties.

Climate does not vary dramatically over the area, but significant microclimates exist, and precipitation varies from 500 mm (20") to over 1000 mm (40") per year. The areas of lowest precipitation are along the coast and to the east of the Santa Cruz mountains dropping to the bay. Along the coast, frequent fogs are a significant moisture source due to fog drip and decreased evaporation rates. The mountainous uplands are the wettest, especially on north- and east-facing slopes with low evaporation rates.

Living Organisms vary with other factors, and often "co-evolve" with soils, but we can see a broad correlation with microclimate and parent material. Grasses, forbs, and coastal scrub dominate close to the coast; here soils develop characteristically dark mollic epipedons. Coniferous forests, usually dominated by Douglas Fir or Redwood, frequent the moister and steeper sites in the Santa Cruz Mountains, and are associated with soils with little clay accumulation and relatively pale-colored surface horizons. Mixed oak-tanoak-madrone forests are found on somewhat more gradual slopes where argillic (Bt) horizons have developed. Beyond the San Andreas fault, low hills vegetated primarily with grass, oaks, and scattered shrubs have developed mollisols broadly similar to the coastal areas. Bay marginal environments (where undeveloped) are significant wetlands, with pickleweed, saltgrass, and cordgrass; here clay-rich, gleyed soils become prominant.

Topography is characterized by parallel ridges of significant structural control, with fairly steep slopes and high erosion rates in upland areas. We've already mentioned the significance of aspect on vegetation. Steep slopes limit accumulation of soil materials in some areas. The thickest soils are lower on the slopes, though much of the soil may be colluvium. The best profiles of significant inter-horizon translocation can be found in soils developed in old alluvium.

Time has generally been short for the soils in this area, but there are significantly contrasting examples. The Sirdrak soils are perhaps the youngest described, and have only a minor accumulation of A horizon. At the older end of the spectrum are the Fagan soils, at a slightly higher elevation and in a relatively more stable landscape, stable enough for an argillic horizon to form. The B horizon contains more clay than the A, carbonates have been leached from the parent material, and reaction is slightly acid or medium acid. In steeper soils, erosion rates equal the rates of soil formation, and soils remain "young".

Route: Leave 8:00 a.m. from SFSU, proceed to Thornton Beach overlook at end of John Daly Blvd.

Stop 1. Soils on Uplifted Coastal Dunes

Suborder ***Ustepts***
inceptisol with ustic moisture regime – common on the Calif. Coast.
Great Group ***Dystrustepts***
dystr- low base saturation

Sirdrak Series. Sandy, mixed, isomesic Humic Dystrustepts

factors: PM dune sand; time-limited

properties: sand! nonsticky, nonplastic; high permeability, low available water, strongly to slightly acid throughout; weak blocky structure only in A1 horizon, otherwise massive

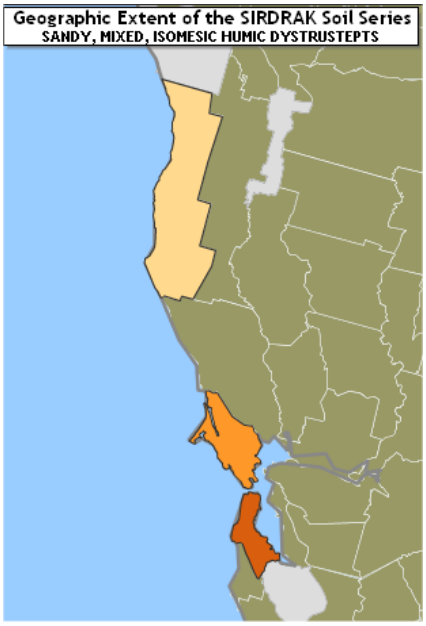
profile of typical pedon:

A1 0-23 : dark brown (10YR 4/3; range 4/2-4/4; moist 2/2-3/2) sand

A2 23-43 cm: dark yellowish brown (10YR 4/4) sand

C1 43-71 cm: yellowish brown (10YR 5/4; range 4/4-6/4 or 2.5Y 4/2; moist 10YR 4/4 or 2.5Y 4/2)

C2 71-152 cm: yellowish brown (same) sand

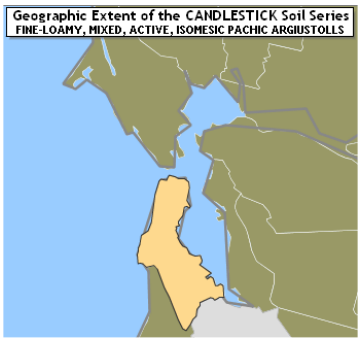


References and all quotes:

1. South of Montara State Beach to North Peak area, and west of Fifield-Cahill Ridges: USDA Soil Conservation Service *Soil Survey of San Mateo Area, California* (Series 1954, no. 13).
2. North and East areas: USDA Soil Conservation Service *Soil Survey of San Mateo County, Eastern Part, and San Francisco County, California* (issued May 1991).

Route: Skyline Boulevard to Hwy 1, across San Andreas Fault, into Pacifica. Hillside soils developed predominantly on hard fractured sandstone, vegetated by coastal scrub & grass, and characterized by dark soils such as mollisols. Past Sharp Park Blvd exit and Fairway Drive, look for sign on right for Mori Point GGNRA.

Stop 2. Coastal Mollisols developed on Sandstones



Candlestick-Kron-Buriburi complex

Note two topographic positions, and Buriburi associated with Eucalyptus forest vegetation. Climate: typical along the coast -- limited precip 500-750 mm (20-30"), but significant fog. These three series are only described in the San Mateo E/SF survey.

Candlestick Series (40%):

fine-loamy, mixed, isomesic Pachic Argiustolls

on lower side slopes and toe slopes; mod. slow permeability, low to mod. avail. water

A1 0-5 cm: brown (10YR 5/3; range 4/2-5/3, moist 2/2-3/3) fine sandy loam; med. to sl. acid

A2 5-36 cm: brown (10YR 5/3) loam

A3 36-51 cm: brown (10YR 5/3) loam

Bt 51-61 cm: pale brown (10YR 6/3; range 4/3-6/3; moist 3/3-4/4) sandy clay loam

R 24": hard fractured sandstone

Suborder ***Ustolls***
ustic soil moisture regime
US Great Plains wheat belt and Dust Bowl, developed on prairie grasses
Great Group ***Argiustolls***
has an argillic horizon

Kron Series (25%): loamy, mixed, isomesic Lithic Haplustolls

shallow soils on upper and middle side slopes; mod. perm.; low avail. water

A1 0-8 cm: brown (10YR 4/3, range 4/2-5/3; moist 2/2-3/3) sandy loam; med. to sl. acid

A2 8-23 cm: brown (10YR 4/3) loam

A3 23-36 cm: brown (10YR 5/3) loam

R 36 cm: hard fractured sandstone

Great Group ***Haplustolls***
hapl- minimum horizons – with mollisols, usually applied to soils without argillic horizons

Buriburi Series (20%): fine-loamy, mixed, isomesic Pachic Haplustolls

moderately deep soils on upper and middle side slopes

O 5-0 cm: decomposed and undecomposed mat of leaves & twigs (e.g. under Eucalyptus)

A1 0-8 cm: dark grayish brown (10YR 4/2; range 4/2-5/3; moist 2/2-3/3) gravelly loam

A2 8-25 cm: grayish brown (10YR 5/2) gravelly loam

A3 25-41 cm: (similar to A2)

A4 41-76 cm: (also similar, weaker structure)

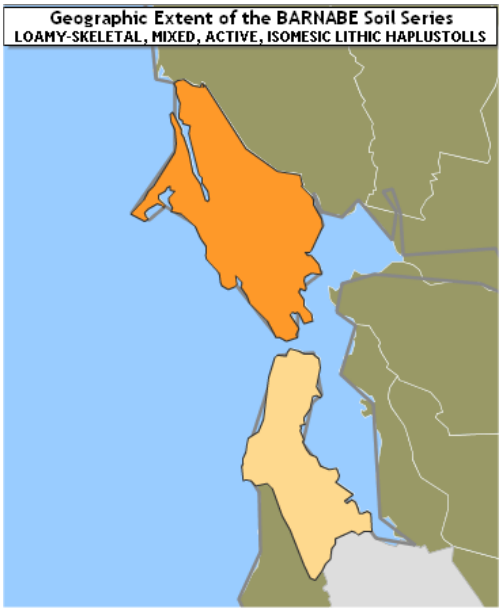
R 76 cm: hard fractured sandstone.

also with significant Orthents (cut & fill) and urban (paved) soils

Suborder ***Orthents***
orth- "true"
with entisols is a catch-all if the soils are not aquents, fluvents, etc., due to a wide variety of soil-development-limiting environments
here represents recently developed land, with cut & fill

Route: South on Hwy 1, left on Linda Mar Blvd, to San Pedro Valley County Park. We may park at the church just to the north.

Stop 3. San Pedro Valley County Park



Barnabe-Candlestick Complex (105)
Barnabe very shallow, very gravelly loam on or near ridgetops, and on steeper side slopes
Barnabe Series loamy-skeletal, mixed, isomesic Lithic Haplustolls

very shallow well-drained soils formed in material weathered from hard, fractured sandstone.

A 0 - 18 cm; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark graish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; 45 % pebbles; slightly acid

Bw 18 - 30 cm: dark grayish brown (10YR 4/2) very gravelly sandy loam; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 50% pebbles; slightly acid;

R 30 cm; hard, highly fractured sandstone.

bedrock at 20 to 50 cm

A & B: slightly to medium acid.

Candlestick (see above): on side slopes: *fewer pebbles, Bt horizon; bedrock at 50 to 100 cm.*

Candlestick Variant
in alluvial fans in valley floors – e.g. along San Pedro valley in the park.
Candlestick Variant : very deep soils on alluvial fans, formed in alluvium,

fine-loamy, mixed, isomesic Pachic Argiustolls

A1 0 - 28 cm; dark brown (10YR 4/3) loam, black (2/1) moist. mod. fine and med. subangular blocky structure; hard, friable, slightly sticky, slightly plastic

A2 28 - 53 cm; brown (10YR 5/3) loam, very dark brown (2/2) moist.

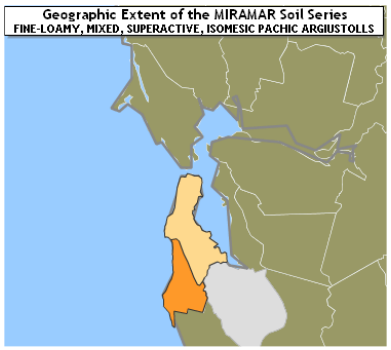
Bt1 53 - 66 cm; yellowish brown clay loam, variegated very dark grayish brown (3/2); very hard, friable, sticky and plastic; slightly acid

Bt2 66 - 117 cm; … similar, with manganese concretions, common moderately thick clay films and bridges; neutral

Bt3 117 - 165 cm; moderately alkaline

Route: continue on Hwy 1 to Devils Slide.
Note coastal processes at work: beach depositional area, erosionally resistant headlands.
Just south of Pacifica, mapped as "Barnabe-Candlestick Complex," Candlestick soils still occur on lower slopes, but upper hillslopes replaced with Barnabe loamy-skeletal, mixed, isomesic Lithic Haplustolls, with a much thinner A horizon, a weak B horizon, and a very gravelly texture -- associated with steeper slopes and thus greater erosion. At Devils Slide on the edge of San Pedro Mountain, note beds of clastic sediments, including conglomerates on right. Sequence was deposited in subduction zone as deep marine sediments, as typical for most of Coast Range, and continues to experience isostatic uplift. Pass through Montara Mountain granodiorites. We may stop at a pullout on the right to see granitic weathering. Just before Montara Beach, we'll try to park at a small pullover on the left; if full, we'll park at the first Montara Beach parking lot.

Stop 4. Montara Mountain granodiorite



Scarper-Miramar Complex

PM: granodiorite

Cl: 560-1140 mm (22-45") rain -- greater at higher elevations (up to 600 m) farther from the coast.

Veg: coastal shrubs & grasses

Miramar Series: Fine-loamy, mixed, superactive, isomesic Pachic Argiustolls

W (windward sites)

moderately deep, well drained soils; slightly hard, blocky structure

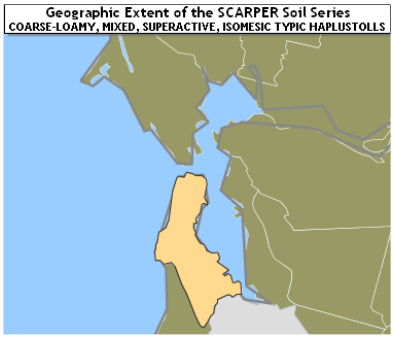
A1 0-18 cm: dark grayish brown (10YR 3-5/2); moist 2/1 to 3/2) loam; strong str.

A2 18-38 cm: dark grayish brown (10YR 4/2) loam

Bt 38-61 cm: brown (10YR 5/3 : range 3/4-5/4; moist 2/1-3/2) clay loam; weak str.; slightly sticky and plastic

BC 61-74 cm: yellowish brown (10YR 5/4) loam

Cr 74 cm: weathered granodiorite



Scarper Series: Coarse-loamy, mixed, superactive, isomesic Typic Haplustolls

somewhat similar to 1954 "Sheridan" series.

A1 0-13 cm: dark grayish brown (10YR 4/2: range 3/2 to 5/3, moist 2/2 to 4/3)

A2 13-41 cm: very dark grayish brown (10YR 3/2)

C 41-64 cm: brown (7.5YR 4/2; range 7.5YR or 10YR 4/2 to 5/3; moist 3/2 to 4/3)

Cr 64: granodiorite

Route: passes onto coastal terraces. Broad low terrace at Half Moon Bay has provided excellent (though erosion-prone) soils for artichokes, flowers, and brussel sprouts, but urban encroachment has become a significant factor here.

Stop 5. Beach Environments & Lower Coastal Terraces at Montara State Beach

Typic Argiustolls -- in alluvium on lowest terraces, 20-30" precip. slightly acid A1, med. acid below

A1 0-15 cm: grayish brown (10YR 5/2, range 3/1-5/2) sandy clay loam (range loam to clay loam)

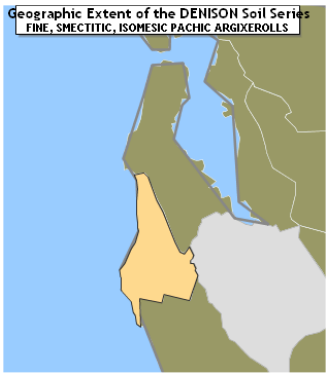
A2 15-28 cm: grayish brown (10YR 5/2) sandy clay loam; sticky and plastic

Bt1 28-38 cm: yellowish brown (10YR 5/4) **clay** (moist: variegated strong brown 7.5YR 5/8 and very pale brown 10YR 7/4); common fine distinct brownish yellow (10YR 6/6) mottles; extremely hard, firm, sticky and plastic

Bt2 38-79 cm: brownish yellow (10YR 6/6) sandy clay loam (moist: also variegated, with mottles); very hard, firm, sticky and plastic.

Bt3 79-94 cm: variegated yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) sandy clay loam (moist: strong brown 7.5YR 5/6) and very pale brown (10YR 7/3)). very hard, firm, sticky and plastic

BC 94-152 cm: same color as Bt3, hard, firm, only slightly sticky and slightly plastic



The above is from the Eastern San Mateo County survey. The older western survey describes a soil from the same area:

Denison -- Fine, smectitic, isomesic Pachic Argixerolls

very deep, moderately well drained soils developed from moderately fine textured granitic alluvium, only found north of Half Moon Bay on lower terraces below Montara Mountain.

A1 & A2—0-25 cm; black (10YR 2/1) clay loam with common fine white specks (due to quartz grains); plastic and sticky when wet; numerous worm casts; abrupt smooth lower boundary. (4 to 7 inches thick)

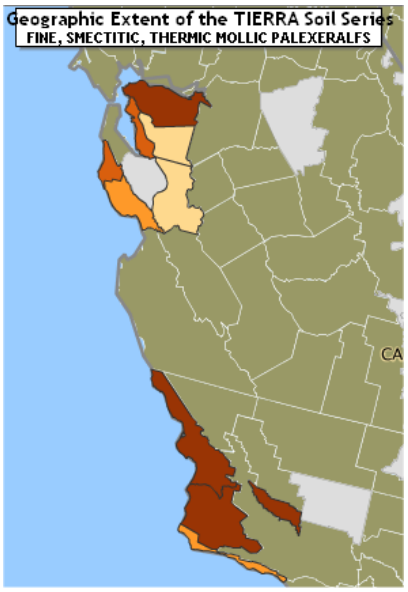
Bt1—25-58 cm & **Bt2** (58-86 cm); black (10YR 2/1) clay, black (10YR 2/1) moist with common fine white specks; strong very coarse prisms break to weak coarse blocks; extremely hard when dry, firm when moist, very plastic & sticky when wet; moderate continuous clay films; hard "shot" 3 mm concretions, slightly acid, pH 6.2; slickensides in Bt2.

Bt3—86-114 cm; mottled dark gray and light yellowish brown (2.5Y 4/1 and 6/3) clay, very dark gray and olive brown (2.5Y 3/1 and 4/3) moist with common fine white specks; weak coarse prisms break to moderate medium blocks; extremely hard when dry, firm when moist, very plastic and very sticky when wet; very few very fine roots; many very fine, mainly tubular pores; moderate, continuous clay films, common slickensides; "tongues" of Bt2 horizon penetrate this horizon; neutral, pH 7.0; clear wavy lower boundary. (10 to 18 inches thick)

C1, C2, C3—114-178 cm; olive (5Y 5/3) to 2.5Y heavy clay loam, darker olive (5Y 4/3) moist with common fine and medium mottles of black, yellowish brown and white; weak, coarse prisms break to weak medium, fine and very fine blocks; very hard when dry, firm when moist, very plastic and sticky when wet; very few, very fine roots; many very fine , mainly tubular pores; moderate, continuous clay films; common slickensides; neutral, pH 7.3; clear wavy lower boundary.

Route: Continue south on Hwy 1. Many views of farms on rich mollisols supporting market gardening agriculture. Older upper terraces form low hillsides to the north and south of the road, and these are classified as Palexeralfs, typified by the Tierra soils of the 1952 soil survey.

Stop 6. Tierra Soils Mollic Palexeralfs



- higher (older) terraces
- more strongly acid
- severe sheet & gully erosion
- Use: pasture
- epipedon : probably umbric

A1 0-33 cm: very dark gray (10YR 3/1) fine sandy loam; black when moist; weak coarse and medium granular structure, hard when dry, strongly acid pH 5.2.

A2 33-53 cm: very dark to dark gray (10YR 3-4/1) fine sandy loam, black (2/1) when moist; mottles of light gray, pH 5.7;

Bt 53-127 cm: dark grayish brown (10YR 4/2) to finely mottled light brownish gray and yellowish brown (2.5 Y 6/2 and 10YR 5/6) clay loam. very plastic and sticky when wet. neutral pH 6.8.

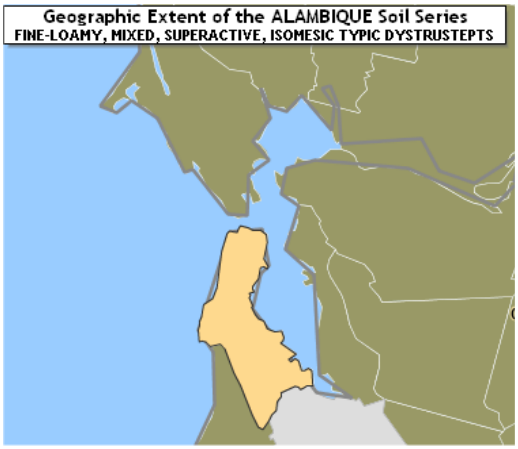
C 127-152 cm: finely mottled light brownish gray and yellowish-brown (2.5Y 6/2 and 10YR 5/4) sandy clay loam. very plastic and sticky when wet. may be many feet thick.

Suborder ***Xeralfs***
alfisols : from "pedalfers"; 35-50% base saturation, usually forested -- in eastern US, found just E (wet side) of mollisols
xeric moisture regime
one of the most common suborders in California, often associate with oak woodland sites

Great Group ***Palexeralfs***
pale - "old" (as in paleontology), almost a catch-all for not a special xeralf, though may have more translocated clay than a haploxeralf, the true catch-all.

Route: Hwy 1 to Half Moon Bay, E on Hwy 92 and turn left to continue east into the Santa Cruz Mountains. As the road progresses up Pilarcitos Creek valley, nearby soils continue to be Argiustolls developed in relatively recent alluvium. Soils on hillides change from alluvial terrace parent materials through mudstones and sandstones until, at about the crossing of Nuff Creek (approx. 2.7 miles from Hwy 1), to a brief return to the Montara granodiorite and related soils (mainly to the north). Just past the crossing of Pilarcitos Creek, the granodiorite ends, and a slab of basalt is crossed, just as the road starts to switchback up into the hills. The basalt ends at the Pilarcitos Fault just before a prominent left bend; the road then climbs onto rocks and soils similar to what we were seeing back on the hillsides in Pacifica: Barnabe-Candlestick Complex developed on metasediments -- sandstones and mudstones of the Franciscan assemblage. Turn right on Skyline Drive and continue to Purisima Creek Open Space Reserve on right, shortly after entering forest.

Stop 7: Forested Soils on Skyline Road



Alambique-McGarvey Complex 30 to 75% slopes

45% Alambique on conifers, hardwoods and shrubs
35% McGarvey on tanoak and redwoods

Alambique fine-loamy, mixed, isomesic Typic Dystrustepts

- typical PM for this series is weathered sandstone
- base saturation < 50% throughout
- note similarity of classification to Sirdrak Series, developed on dune sands
- actually soils on Cahill Ridge are considered a taxadjunct to Alambique, similar in use and management factors, but outside the range for Alambique due to a lithic contact.

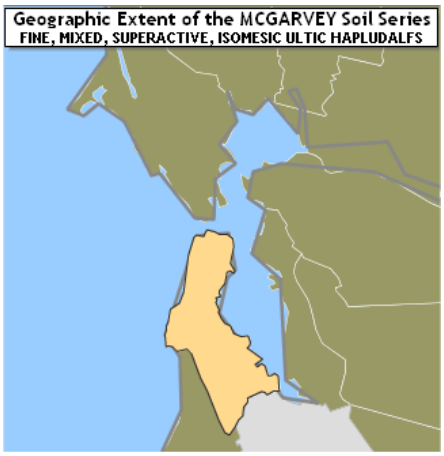
O +8 cm to 0: decomposed and undecomposed duff (firm organic layer on the surface, consisting of fallen plant material in the process of decomposition -- includes everything from litter to humus), consisting of tanoak, madrone, manzanita, and live oak leaves and twigs.

A1 0-15 cm: brown (7.5YR 5/4) gravelly loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; very friable, slightly sticky and slightly plastic; 20% angular pebbles; 2-3 % manganese concretions on the surface; medium acid; diffuse smooth boundary.

A2 15-30 cm: reddish yellow (7.5YR 7/6), dark brown (7.5 YR 4/4) moist, otherwise similar to A1

Bw 30-76 cm: reddish yellow (7.5YR 7/6); 35% pebbles; strongly acid; medium to coarse blocky str.

Cr 76 cm: weathered sandstone



McGarvey fine, Fine, mixed, superactive, isomesic Ultic Hapludalfs

0 +10 cm to 0 tanoak and redwood leaves and twigs, at various levels of decomposition.

A1 & A2--0 to 18 cm; pinkish gray (7.5YR 6/2) to light brown (7.5YR 6/4) loam, brown to dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many coarse to fine roots; many very fine and fine tubular and iterstitial, and common medium tubular pores; 10 percent 2 to 5 mm angular pebbles; slightly acid (pH 6.5); gradual wavy boundary

Bt1, Bt2, Bt3—18 to 36 to 69 to 94 cm; light reddish brown (5YR 6/4) clay loam, yellowish red (5YR 4/6) to reddish brown (5YR 4/4) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, slightly sticky and slightly plastic, common coarse and many fine and medium roots; common fine and medium tubular and interstitial pores; 2 percent 2 to 5 mm angular pebbles; common thin clay films on peds, in pores and as bridges; neutral (pH 7.0); gradual to clear wavy boundary.

Cr—94 to 127 cm; soft fractured sandstone with silty clay loam textures between the rocks.

Route: Return to Hwy 92, go E to Canada Road just before I 280. S 4.6 miles on Canada Road to just past the I-280 underpass. Park to the right and we'll hike in from the Clarkia Trailhead here.

If not time, turn left before 280 to follow 92. Stop at serpentinite outcrops nearby.

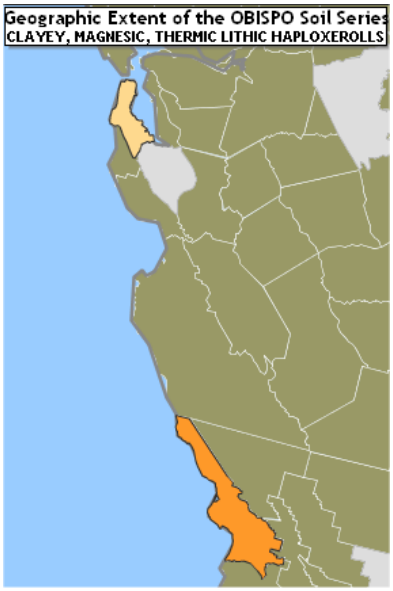
Stop 8: Serpentinite Soils at Edgewood Park (or alternate stop near Hwy 92)

Obispo Clays on serpentinite -- clayey, serpentinitic, thermic Lithic Haploxerolls

A1 0-10 cm: dark gray (10YR 4/1; range 3/1-4/1, moist 2/1, 2/2, or 3/1) clay, strong fine granular and strong coarse subangular blocky structure; "extremely hard, firm, sticky and plastic"; moderately alkaline

A2 10-30 cm: very dark gray (10YR 3/1) clay (or clay loam); strong coarse and very coarse (up to 10 cm) subangular blocky structure, similar consistency

R 30 cm: hard, serpentinitic rock.



Route: To return home, get on I-280.

If time for Stop 9, take Hwy 92 and go east towards San Mateo & Foster City. Hillsides are Fagan loam on grassier slopes, Los Gatos on forested slopes, with Maymen gravelly loams (xerochrepts) on steeper eroded slopes. Note increases in urban development -- soils are cut-and-fill Orthents if not paved. Continue to Foster City Boulevard exit, then follow this boulevard southeast till it ends at Beach Park Blvd; then turn left and park in about 300 feet.

If extra time (unlikely):

Stop 9: Novato Clays on alluvial tidal marsh muds -- fine, mixed, nonacid, isomesic Typic Hydraquents

A1g 0-15 cm: gray (5Y 5/1; range 5/1-6/2 or 2.5Y 5/2-6/2, moist 5Y 4/1-4/2, N 3/0 or 2.5Y 3/2-4/2) clay, with 10YR 3/4 mottles; extremely hard, firm, sticky and plastic;. moderately alkaline.

A2g 15-41 cm: light olive gray (5Y 6/2) clay, moist variegated olive gray (5Y 4/2) and very dark gray (N 3/0), with mottles. massive, extremely hard, firm, sticky and plastic.

C1g 41-76 cm: gray (5Y 5/1) clay with distinct pale yellow (5Y 8/4) jarosite (a sulfate) mottles

C2g 76-114 cm: dark gray (10YR 4/1), very dark gray (N 3/0) moist -- no mottles

C3g 114-152 cm: basically the same

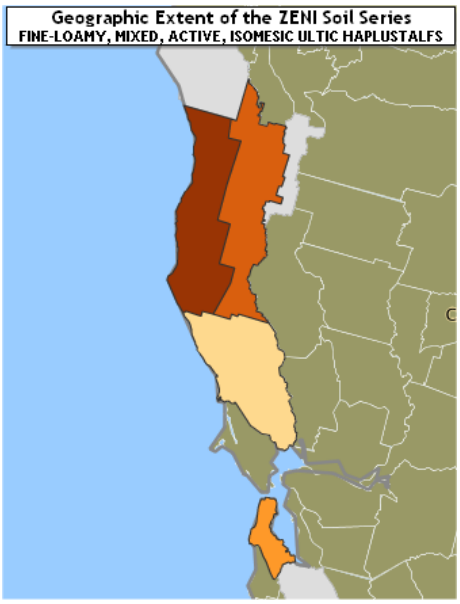
Other soils in the Area (inaccessible without entering PUC land)
San Andreas Lake & Crystal Springs Reservoir Area…San Mateo Creek valley, soils mapped as ***Candlestick variant*** *(on alluvial fans) are characterized by relatively thick Bt horizons (to 165 cm, in contrast to Candlestick, to 61 cm) and very high available water (similar to the Pilarcitos Creek Botella loam from the 1952 soil survey). Then climb back onto Candlestick-Kron-Buriburi complex 30-75% slopes as we cross the interfluve to San Andreas Lake drainage.*

West of San Andreas Lake, we encounter ***Zeni-Zeni Variant*** *soils, vegetated by oaks, tanoak, madrone, manzanita, and some conifers. Zeni soils are those typical of California oak woodlands -- alfisols, characterized by pale brown (10YR 6/3) surface horizons and reddish yellow (7.5YR 7/6) subsoils.*

Zeni Series Ultic Haplustalfs

Note: B horizon indicated by color change.
O +1 cm to 0: leaves and twigs
A1 0-8 cm: pale brown (10YR 6/3; range 6/2-7/3; moist 4/4-5/3 or 7.5 YR 4/4) gravelly loam.
A2 8-23 cm: same color
Bt1 23-46 cm: reddish yellow (7.5YR 7/6; or 10YR 7/3-8/4; moist 5YR 4/6, 7.5YR 5/4-5/6, or 10YR 5/4-6/4); slightly sticky and slightly plastic
Bt2 46-66 cm: very pale brown (10YR 7/4; same range) slightly sticky and slightly plastic
Cr 66 cm: sandstone

Suborder ***Ustalfs***
Widespread distribution in generally dry subtropical climates -- associated with mollisols in Texas, in Sahel of Africa, the Indian Rajasthan region, the Bahia province of Brazil.
In California, seems to be intermixed and often confused with ***xeralfs***. I've observed a tendency for soils mapped previously as xeralfs being reclassified as ustalfs. Why? I'm not sure.



Route: San Andreas Lake, east end of dam, turn right and go through gate -- follow it through woods to grassy area -- should be Fagan Loam. Fagan loam occurs on most grassy-mixed areas.

Fagan loam -- fine, montmorillonitic, thermic Typic Argixerolls
Probably the most developed soil in the area, with a clear Bt horizon, developed on "soft sandstone and shale", vegetated with "annual grasses, forbs, and some brush."
A1 0-13 cm: brown (10YR 5/3; range 4/2-5/3; moist very dark grayish brown 3/2-3/3) loam
A2 13-28 cm: grayish brown (10YR 5/2) clay loam
BA 28-48 cm: grayish brown clay loam -- sticky & plastic
Bt1 48-66 cm: yellowish brown (10YR 5/4; range 5/2-5/4, moist variegated 3/2 & 4/4) clay loam; common fine distinct reticulate grayish brown (10YR 5/2) mottles; coarse angular blocky structure; very sticky and very plastic
Bt2 66-91 cm: same color; many mottles; very hard, firm
Bt3 91-109 cm: same with no roots
Cr 109 cm: soft, highly weathered sandstone & shale

USDA-NRCS | **PEDON DESCRIPTION** | **PEDON ID #:** | **DRAFT 3/2002**

Series or Component Name: Caveat Emptor	**Map Unit Symbol:** CaC	**Photo #:** 127A	**Classification:** fine, smectitic, mesic, Typic Argiudoll		**Soil Moist. Regime (Tax.):** Udic (≈ 27" annual)
Describer(s): PJS & DAW	**Date:** 10/12/2000	**Weather:** sunny	**Temp.:** Air: 78 °F Soil: Depth:	**Latitude:** 40 ° 49 ' 10.0 " N **Longitude:** 96 ° 46 ' 06.1 " W	**Datum:** NAD '83
Location: NE 1/4, SW 1/4 Sec. 20 T. 10N R. 6E					
UTM: Zone : mE: mN:	**Topo Quad:** Emerald, NE 7.5 topo 1978	**Site ID:** S	**Yr:** 2002	**State:** NE	**County:** 109	**Pedon #:** 006
Soil Survey Area: Lancaster, Co	**MLRA / LRU:** 106	**Transect:** ID: 2 Stop #: 6 Interval: 10m			

Landscape: upland	**Landform:** low hill	**Microfeature:** ———	**Anthro:** furrow	**Elevation:** 1240 '	**Aspect:** 34 °E	**Slope (%):** 6%	**Slope Complexity:** simple	**Slope Shape:** (Up & Dn / Across) V V (convex, convex)
Hillslope Profile Position: shoulder	**Geom. Component:** nose slope	**Microrelief:** micro-low	**Physio. Division:** Interior Plains	**Physio. Province:** Central Lowland	**Physio. Section:** Dissected Till Plain	**State Physio. Area:** ———	**Local Physio. Area:** Middle Creek Basin	
Drainage: WD (Well Drained)	**Flooding:** none	**Ponding:** none	**Soil Moisture Status:** moist	**Permeability:** slow (est.) low (ave. = 0.011 cm/hr; K_{sat}: n=3; depth: 35–50 cm)	**Land Cover / Use:** Soybeans (CRC)			
Parent Material: loess, over pedisediment, over till	**Bedrock:** Kind: Sandstone	Fract.:	Hard.:	Depth: (in adjacent gully) > 15 m	**Lithostrat. Units:** Group: Peoria Loess, Gillman Canyon, unnamed pedisediment, unnamed till	Formation:	Member:	
Erosion: R (Rill)	Kind:	Degree: 1	**Runoff:** VH (Very High)	**Surface Frag %:** GR: CB: ST: BD: CN: FL: – 0 – Kind:	**Diagnostic Horz. / Prop.:**	Kind: mollic argillic	Depth: 0 – 30 cm 30 – 90 cm	
P. S. Control Section : Depth Range: 30 – 80 cm	Ave. Clay %: 37%	Ave. Rock Frag %: < 1%						

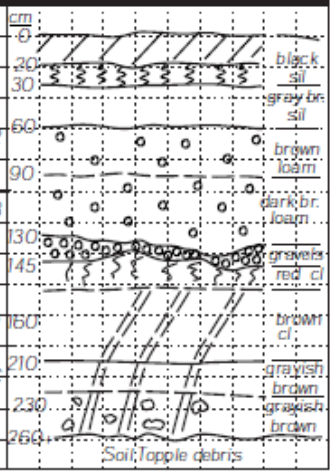
VEGETATION :

SYMBOL	COMMON NAME	% GD COVER
GLYCI	Soybean stubble	1%
DIGIT2	Crabgrass	5%

MISCELLANEOUS FIELD NOTES / SKETCH :

deep polygonal joints in till:
≈ 30° angle; 10 - 20 cm diam.
20 white, $CaCO_3$ lined seams (1-4 cm diam.) in center
bounded by brown / black Fe / Mn zone which is bounded by yellow / br. Fe (goethite) halo at 250 cm depth.

Peoria Loess: loess Ap; A; Bt 1; colluvial loess with scattered gr. Bt 2
Gillman Canyon pedisediment: colluvial loess 2 Bt 3; red paleosol 3B; weathered, oxidized leached 4Bt 1; 4Bt 2; mottled, unoxidized leached 4 BC
Pre-Illinoian till: mottled, unoxidized, unleached 4C



	Component Name:				Map Unit Symbol:							Date:											
	Obser. Method	Depth (in) (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Rock Frags Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
1	LP	0 – 20	Ap	Abrupt Smooth	10YR 4/2	10YR 3/1	silt loam (sil)	— 0 —			common, fine & med. granular			Slightly Hard	Friable	non-sticky	non-plastic	None						
2	LP	20 – 30	A	CW	10YR 4/2	10YR 3/1	sil	— 0 —			3 f,m abk.			MH	FI	SO	PO							
3	LP	30 – 60	Bt1	GW	2.5 Y 6/2	10YR 5/3	sicl	— 0 —			2 m,c sbk			H	VFI	SS	MP							
4	LP	60 – 90	2Bt2	GW	10YR 6/3	70% 10YR 4/3 30% 10YR 5/3	sicl	2% scattered f,m rounded gr.			2 m pr ⇒ 2 m sbk			H	VFI	SS	MP							
5	LP	90 – 130	2Bt3	AW	10YR 4/4	40% 7.5YR 4/3 60% 7.5YR 3/3	sil	2% scattered f,m rounded gr.			1 m, co. pr ⇒ 2 m sbk			MH	FI	SS	SP							
6	LP	130 – 145	3B	AW	7.5YR 5/4	7.5YR 4/6	xgrscl	85% f, m, co. rounded gravels mixed lithology			0 sg			L	L	SO	SO							
7	LP	145 – 160	4Bt1	GW	7.5YR 5/6	7.5YR 4/6	cl	10% f, rounded gr., mixed lithology			2 m sbk ⇒ 3 vf,f sbk			VH	EF	MS	MP							
8	LP	160 – 210	4BT2	DW	7.5YR 4/4	7.5YR 4/4	cl	1% f,m rounded gr., mixed lithology			3 co., vco pr ⇒ 3 f, m sbk			EH	SR	MS	MP	15%	coarse, faint,	10 YR 4/3	M,	irregular,	on ped faces	
9	LP	210 – 230	4BC	DI	2.5YR 7/2	2.5YR 5/2	c	1% f,m rounded gr., mixed lithology			3 co, vco pr ⇒ 2 m sbk			EH	R	VS	VP	None						
10	SP	230 – 260+	4C	—	2.5YR 7/2	2.5YR 5/2	c	1% f,m rounded gr., mixed lithology			3 co, vco pr ⇒ 3 f,m abk			R	R	VS	VP	None						

USDA-NRCS	PEDON DESCRIPTION	PEDON ID #:	DRAFT 3/2002

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Datum: Longitude: ° ' " W	Location: Sec. T. R.

UTM: Zone : mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: K_{sat}:	Land Cover / Use:

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P. S. Control Section : Ave. Clay %: Ave. Rock Frag %: Depth Range:	

VEGETATION :

SYMBOL	COMMON NAME	% GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Component Name:		Map Unit Symbol:		Date:	

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Rock Frags Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
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USDA-NRCS	PEDON DESCRIPTION	PEDON ID #:	DRAFT 3/2002

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather:	Temp.: Air: / Soil:	Depth:	Latitude: ° ' " N	Datum:	Location: Sec. T. R.
					Longitude: ° ' " W		

UTM: Zone : mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: K_{sat}:	Land Cover / Use:

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P. S. Control Section : Ave. Clay %: Ave. Rock Frag %: Depth Range:	

VEGETATION :

SYMBOL	COMMON NAME	% GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Component Name:		Map Unit Symbol:		Date:	

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Rock Frags Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
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USDA-NRCS	PEDON DESCRIPTION	PEDON ID #:	DRAFT 3/2002

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Datum: Longitude: ° ' " W	Location: Sec. T. R.

UTM: Zone : mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding: Ponding:	Soil Moisture Status:	Permeability: K_{sat}:	Land Cover / Use:

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P. S. Control Section : Ave. Clay %: Ave. Rock Frag %: Depth Range:	

VEGETATION :

SYMBOL	COMMON NAME	% GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH :

Component Name:							Map Unit Symbol:										Date:							
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USDA-NRCS **PEDON DESCRIPTION** **PEDON ID #:** **DRAFT 3/2002**

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):
Describer(s):	Date:	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Datum: Longitude: ° ' " W	Location: Sec. T. R.
UTM: Zone : mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:
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Drainage:	Flooding: Ponding:	Soil Moisture Status:	Permeability: K_{sat}:	Land Cover / Use:
Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:		Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:	
P. S. Control Section : Ave. Clay %: Ave. Rock Frag %: Depth Range:				

VEGETATION :

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MISCELLANEOUS FIELD NOTES / SKETCH :

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	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Rock Frags Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
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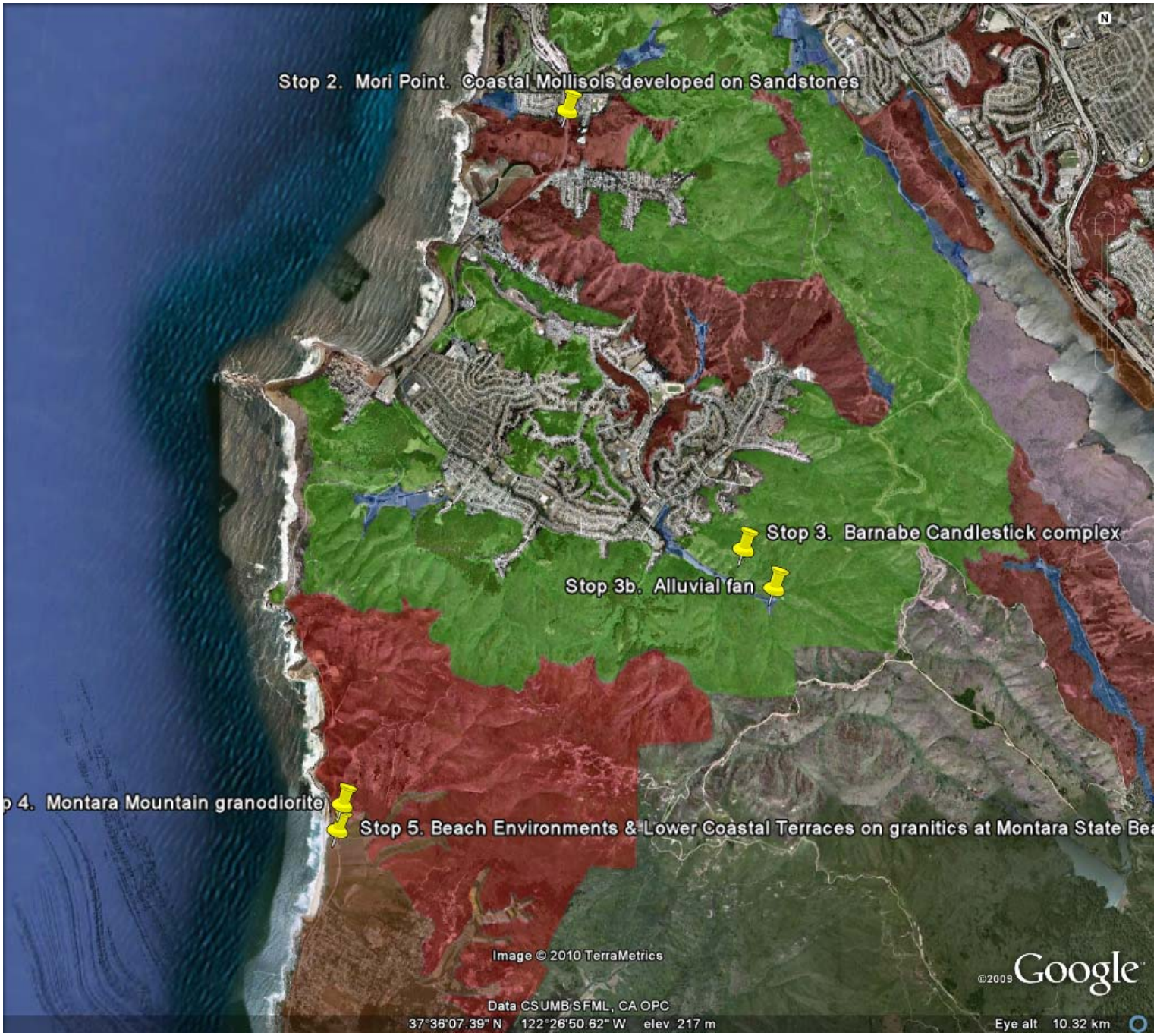
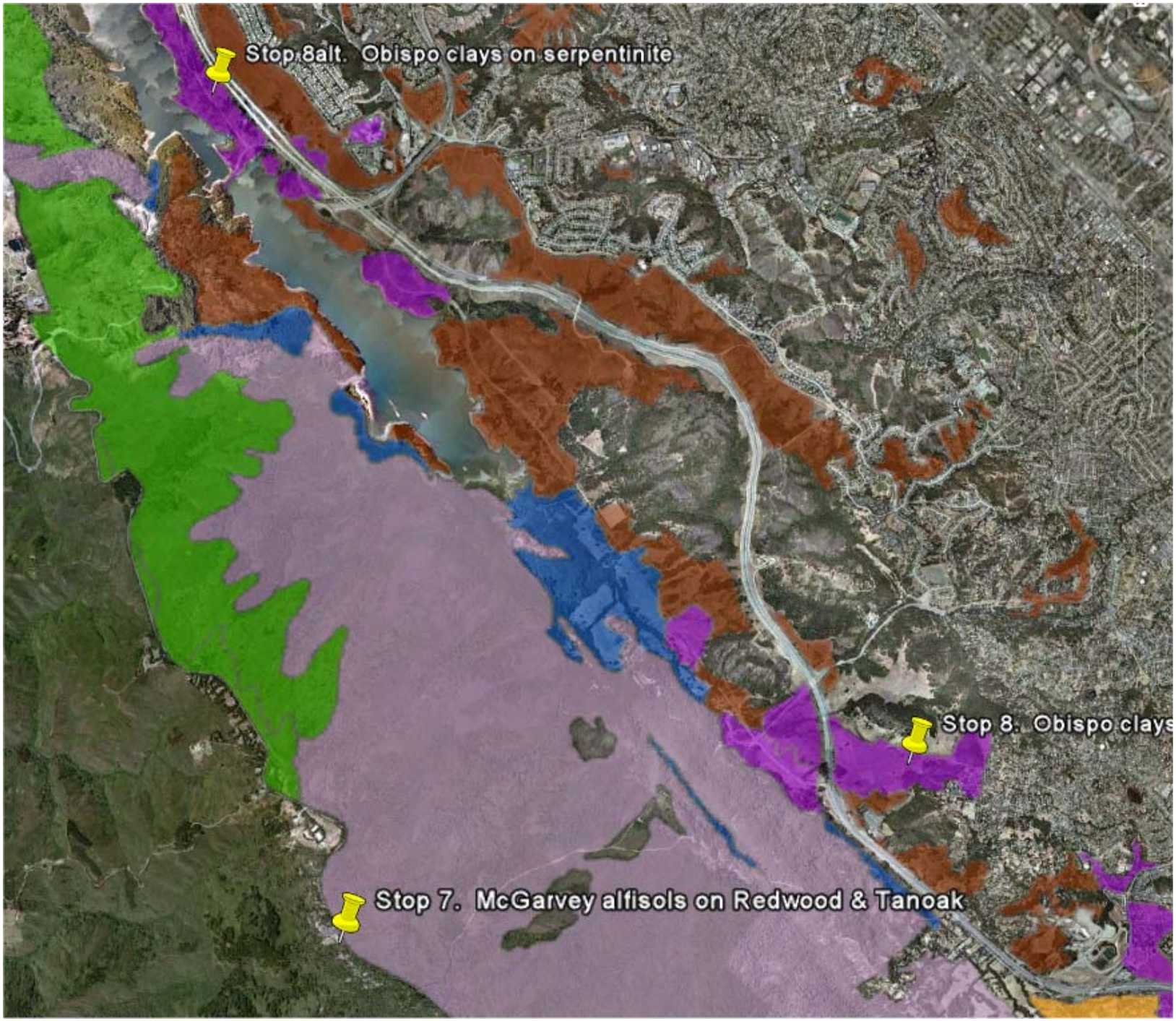

Stop 2. Mori Point. Coastal Mollisols developed on Sandstones
Stop 3. Barnabe Candlestick complex
Stop 3b. Alluvial fan
p 4. Montara Mountain granodiorite
Stop 5. Beach Environments & Lower Coastal Terraces on granitics at Montara State Be
Image © 2010 TerraMetrics
©2009 Google
Data CSUMB SFML, CA OPC
37°36'07.39" N 122°26'50.62" W elev 217 m
Eye alt 10.32 km


Stop 8alt. Obispo clays on serpentinite
Stop 8. Obispo clays
Stop 7. McGarvey alfisols on Redwood & Tanoak