Caltech Tectonics Observatory

Geology Field Trip to Eaton Canyon
May 20, 2010
6th grade and High School
Scientists: Jamshid Hassanzadeh, Janet Harvey, Joel Scheingross, Jeff Thompson, Kristel Chanard

First some safety tips:

What POINSONOUS plant is this? DO NOT TOUCH!!!

"Leaves of three, let it be!"

What animal is this? DO NOT GO NEAR!!!!

Can you find these rocks?

Are they igneous, metamorphic, or sedimentary?
How do you know?

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How do you know?

Can you find this red mineral? What mineral is it?

Hint: It's the January birthstone

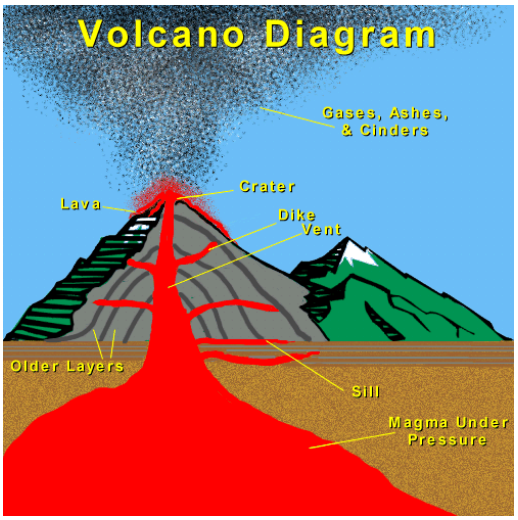
Why do we find this mineral here?

Consider the poorly consolidated sediment. What is the material that binds the pebbles together, and where does that comes from?

Why are there only two types of rocks here in Eaton Canyon?

Why are there no fossils?

Using a hand magnet, search for a magnetic mineral in the sand. What mineral did you find?



Consider the three hand specimens of volcanic rocks. While intrusive (plutonic) rocks are so abundant in these mountains, why we don't see extrusive (volcanic) rocks?

Find a fault surface with striae. What can you say about movement?

How long did it take for this part of the San Gabriel Mountains to reach their present height?

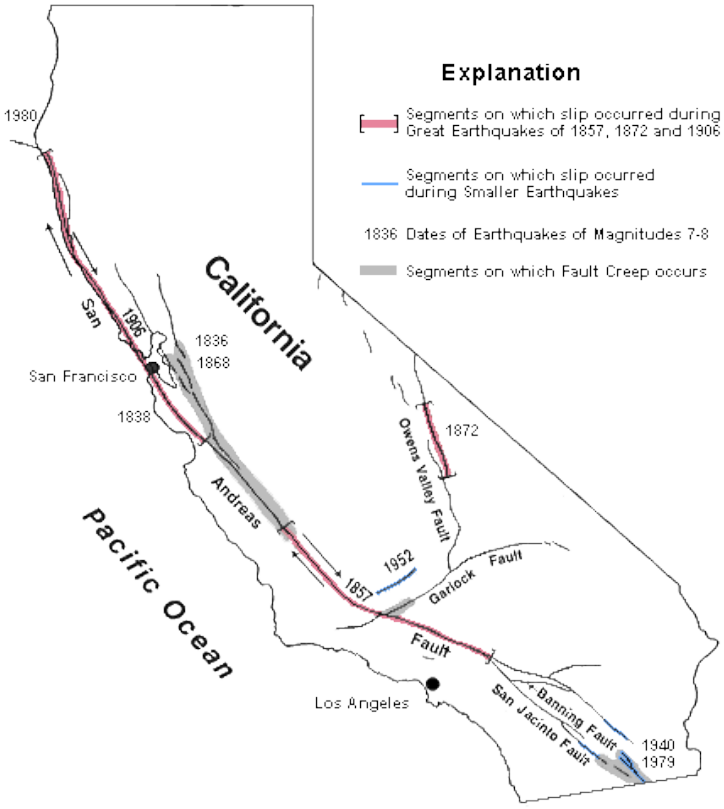
> For the sake of simplicity, pick an average height of 1.5 km for the mountains, and assume an uplift rate along the Sierra Madre fault of 8 mm/yr. Ignore erosion and other effects.

If you found a fault, draw it here:

How do you know this is a fault as opposed to just a crack in the rocks?

Is this the San Andreas fault?

Indicate the location of the fault you found on this map:



Can you find a dyke?

How are dykes formed?

If you have found one, draw it here:

How do rivers carve canyons and how high do they flood?

A little background information:
Rivers are constantly changing. If we came to Eaton Canyon every day for the next year we would see the water slowly disappear to small trickle over the summer. In the winter as it starts to rain, the water in the river rises and there can be large floods.

When rivers flood, they move lots of sand, gravel, and boulders (what geologists call "sediment") downstream. These rocks get pounded against the river bed, and over thousands to million of years can carve deep valleys like the Grand Canyon.

(The Grand Canyon was created by the Colorado River slowly carving downwards over millions of year)

Our Activities For Today:
Just like the Grand Canyon, Eaton Canyon has been carved by river rocks pounding against the ground over thousands of years. Generally, the more water in the river, the more rocks it can move, and the faster it can cut down.

Today we will have two questions:

1. How much has the river in Eaton Canyon cut down?

2. How high did Eaton Canyon flood this past winter?

Activity #1: Where was the river in the past? How much has the river cut down?

To answer this question we will look at the river banks and canyon walls.

Here's another picture of the Grand Canyon. See how flat the top of canyon is?

The river must have started at the top of canyon and cut all the way down to where we see it today!

Look closely at this picture and you'll see that the river bank is made of lots of sand and rounded fist-sized rocks. These rocks used to be in the river, so the river must have made this bank!

Can you find any places in the river banks or canyon walls where you see old river rocks stored? If you can, **draw a picture** of what you see in the space below.

Activity #2: How high did the river flood this past winter?

To answer this question we'll need to explore the area around the river. To start, guess how high you think the water was and go to the place. Once you're there, look around for evidence that there was water at that level. Here are examples:

All the sticks and branches that were floating in the river during a flood got caught on this bridge. This shows the water was at least as high as the bridge.

Can you find examples of this in Eaton Canyon? Look for sticks or branches caught on boulders or trees next to the river.

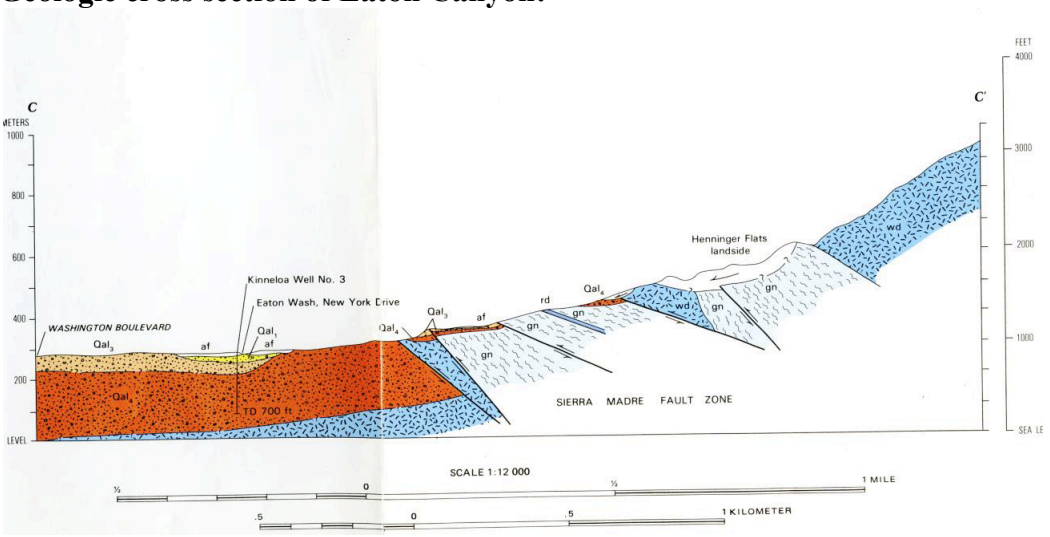
If you find an example, **draw a picture of it** on the back of this page.

These photos are an overview of a river with boulders (left side) and a close up of the boulders (right side). Look carefully and you will see many of the boulders are resting on top of each other in the same direction. As the boulders were moved by the river, the river pushed the boulders all in one direction and stacked them on top of each other. This stacking tells us that the river flows from right to left in the photo.

Do you see any examples of stacked boulders like this in Eaton Canyon? If so, **draw a picture** showing the boulders and the direction of stream flow in the space below.

Appendix

Geologic cross section of Eaton Canyon:



DESCRIPTION OF MAP UNITS

* af — ARTIFICIAL FILL—Includes housing development, flood-control dams, flood-debris storage, and road fill

* Qc — COLLUVIUM (HOLOCENE)—Talus and slopewash, generally brown to reddish-brown poorly sorted heterogeneous deposits of locally derived debris. These deposits are more abundant than indicated on the map but are generally too small to show

* Qal — ALLUVIUM (HOLOCENE AND PLEISTOCENE)

* Qal_1 — UNIT 1 (Holocene)—White to light-gray unconsolidated fine to coarse sand and gravel containing abundant cobbles and boulders; includes deposits of present stream channels, flood plains, and alluvial fans (now mostly controlled by flood-control channels and dams). Qal_1f, alluvial-fan surface

* Qal_2 — UNIT 2 (Holocene)—Gray to pale-brown unconsolidated fine to coarse sand and gravel containing abundant cobbles and boulders; includes deposits of stream terraces, recently abandoned flood plains, and alluvial fans with incipient soil. Qal_2f, alluvial-fan surface

* Qal_3 — UNIT 3 (Pleistocene)—Yellow to yellowish-pale-brown unconsolidated fine to medium sand and gravel containing abundant cobbles and boulders and highly weathered granite clasts; includes stream terraces and moderately dissected alluvial fans with poorly to moderately developed soils. Qal_3f, alluvial-fan surface

* Qal_4 — UNIT 4 (Pleistocene)—Red to reddish-brown or yellow unconsolidated to well-consolidated fine to medium sand and gravel containing few to many cobbles and boulders; all clasts are highly weathered, and deposits have moderate to moderately high clay content and are commonly fractured or jointed; includes terraces and highly dissected and (or) buried fan deposits with highly developed soils. Qal_4f, alluvial-fan surface

QTs — SAUGUS FORMATION (PLEISTOCENE AND PLIOCENE)—Tan to reddish-brown interbedded siltstone and moderately well sorted sandstone

Td — DUARTE CONGLOMERATE (PLIOCENE?)—Tan moderately consolidated boulder conglomerate with well-rounded clasts and a clayey sandy matrix.

Tc — CONGLOMERATE (PLIOCENE?)—Purple to gray moderately consolidated conglomerate composed mainly of volcanic clasts with a silty to sandy matrix.

Tpi — "PICO" FORMATION (PLIOCENE)—Tan to gray well-consolidated sandstone and conglomerate containing minor shale and siltstone commonly called the Pico Formation by some workers

Tf — FERNANDO FORMATION (PLIOCENE)—Subsurface only

Tpu — PUENTE FORMATION (MIOCENE)—Subsurface only

Tm — MODELO FORMATION (MIOCENE)—Tan to gray diatomaceous to cherty shale and siltstone

Tt — TOPANGA FORMATION (MIOCENE)—Tan to brown or reddish-brown interbedded conglomeratic sandstone, sandstone, and shale. Ttv, intercalated volcanic flows

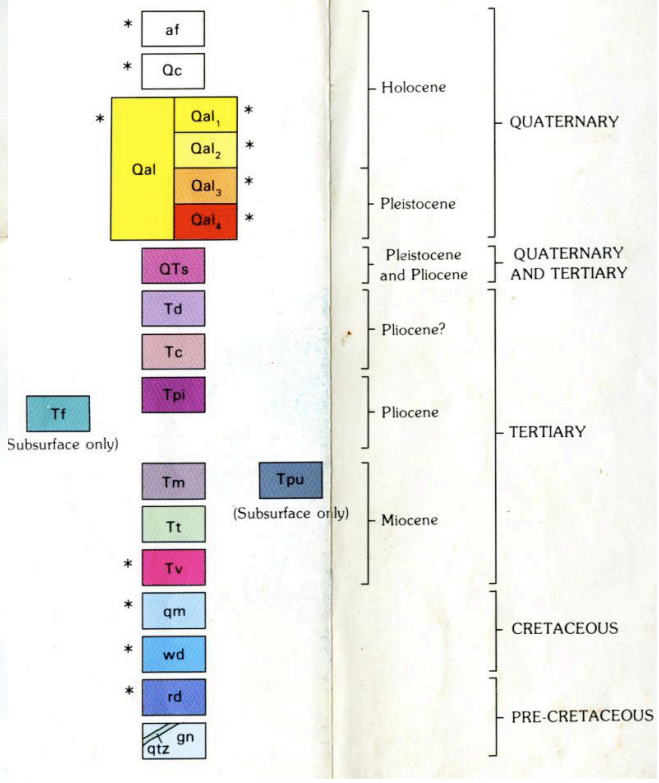
* Tv — VOLCANIC ROCKS (MIOCENE)—Extensive flows and dikes of black dense basalt and andesite. As mapped, includes outcrops of intrusive rocks, most too small to differentiate

* qm — QUARTZ MONZONITE AND GRANODIORITE (CRETACEOUS)—Gray to tan fine-to medium-grained intrusive rocks

* wd — WILSON DIORITE OF MILLER (1934) (CRETACEOUS)—Gray hornblende-biotite-quartz diorite

CORRELATION OF MAP UNITS

* Units on map and section indicated by asterisk

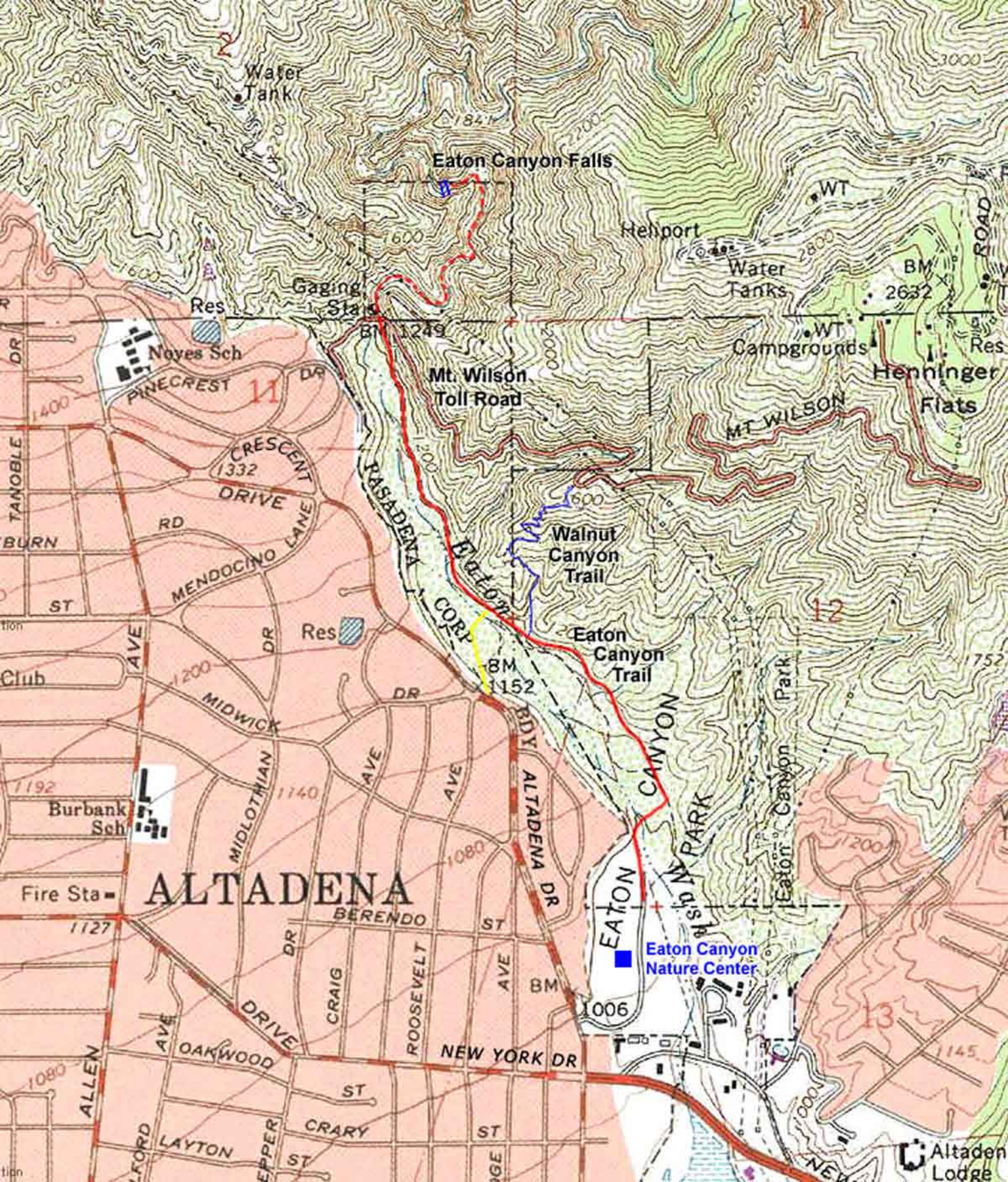


What is basement rock?

What are the types and names of rocks that form the basement rocks in Eaton Canyon?

What is a pluton?

Describe the types of plutonic rock found in Eaton Canyon.


Water Tank
Eaton Canyon Falls
Heliport
WT
Water Tanks
BM 2632
Gaging Sta
Res
BM 1249
Noyes Sch
PINECREST
Mt. Wilson Toll Road
Campgrounds
Henninger Flats
MT WILSON
CRESCENT DRIVE
1332
MENDOCINO LANE
RASADENA
CORP
EATON
Walnut Canyon Trail
Eaton Canyon Trail
Res
BM 1152
Club
MIDWICK
Burbank Sch
MIDLOTHIAN
ALTADENA
Fire Sta
BERENDO
ALTADENA DR
EATON CANYON PARK
Eaton Canyon Nature Center
BM 1006
ROOSEVELT
CRAIG
OAKWOOD
NEW YORK DR
ALLEN
CRARY
LAYTON
Altadena Lodge