

Hillside Natural Area Geology Walk, El Cerrito, CA

By Gary Prost
2017

Outline

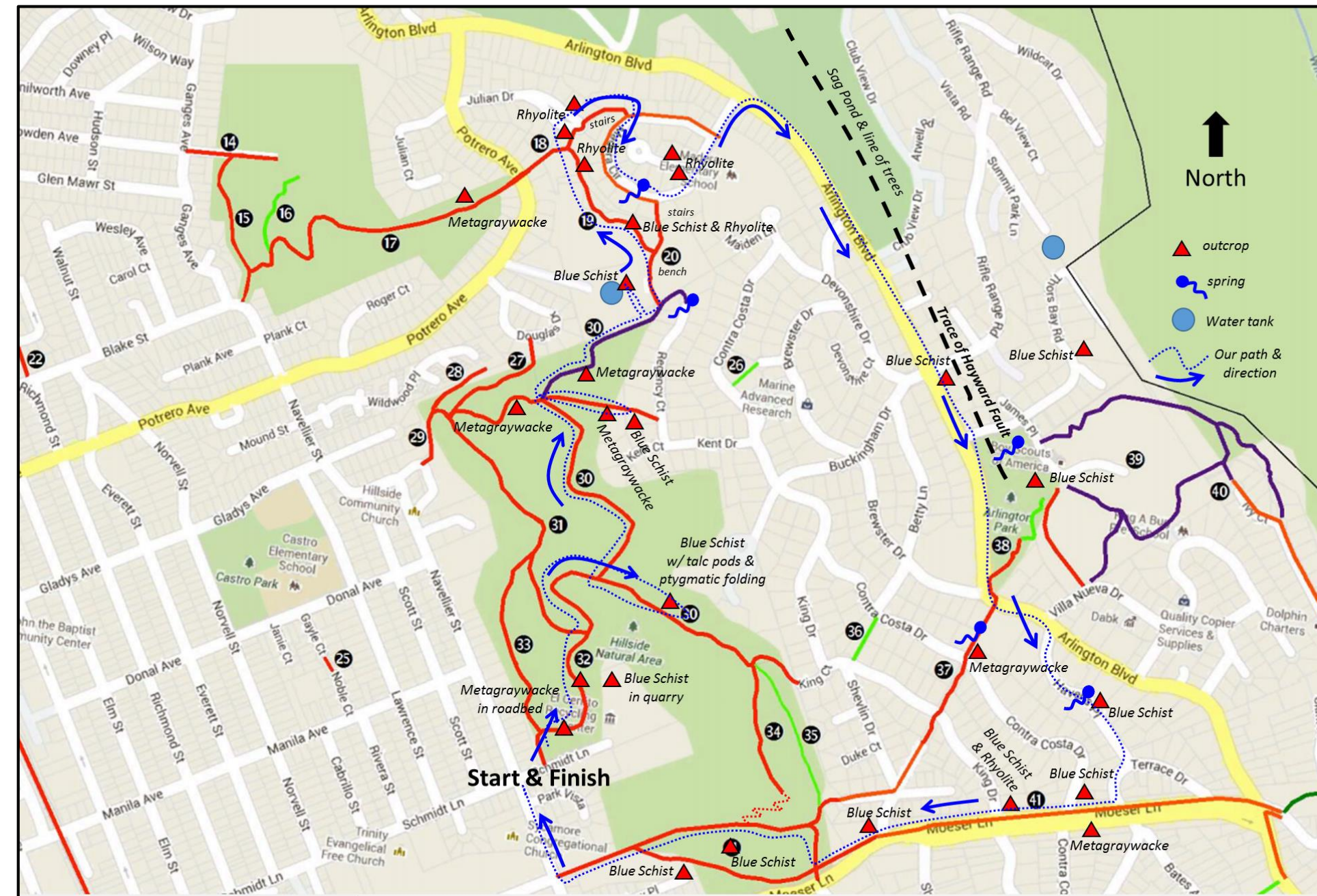
- Map of the Walk and Outcrops
- Geologic Setting of the East Bay
- Local Rocks
 - What Are Metamorphic Rocks?
 - What Have We Got Here?
- Faults & Landslides
- Extra Credit
- Who *is* this guy?



Map of Geology Walk & Outcrops

Our walk is the blue dotted line and blue arrows. Start and finish at trailhead by H&B Quarry and Memorial Grove at the end of Schmidt Lane.

This is a moderate to strenuous hike with several short steep stretches that should take about 3 hours and covers about 3 miles. Bring sturdy shoes, water, a hat, sunscreen, and hiking poles if you use them. There could be ticks in the grass.

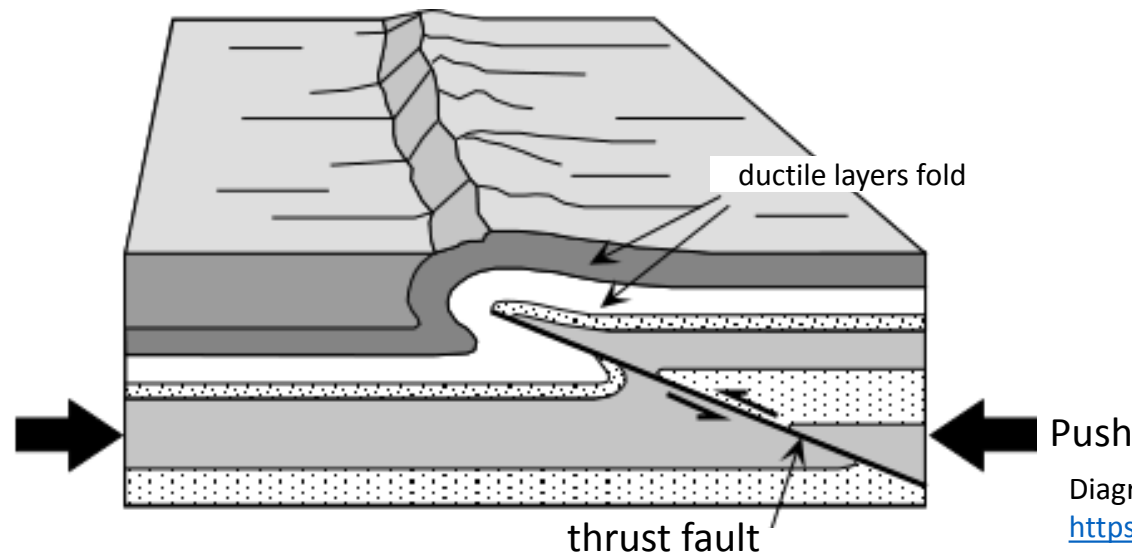
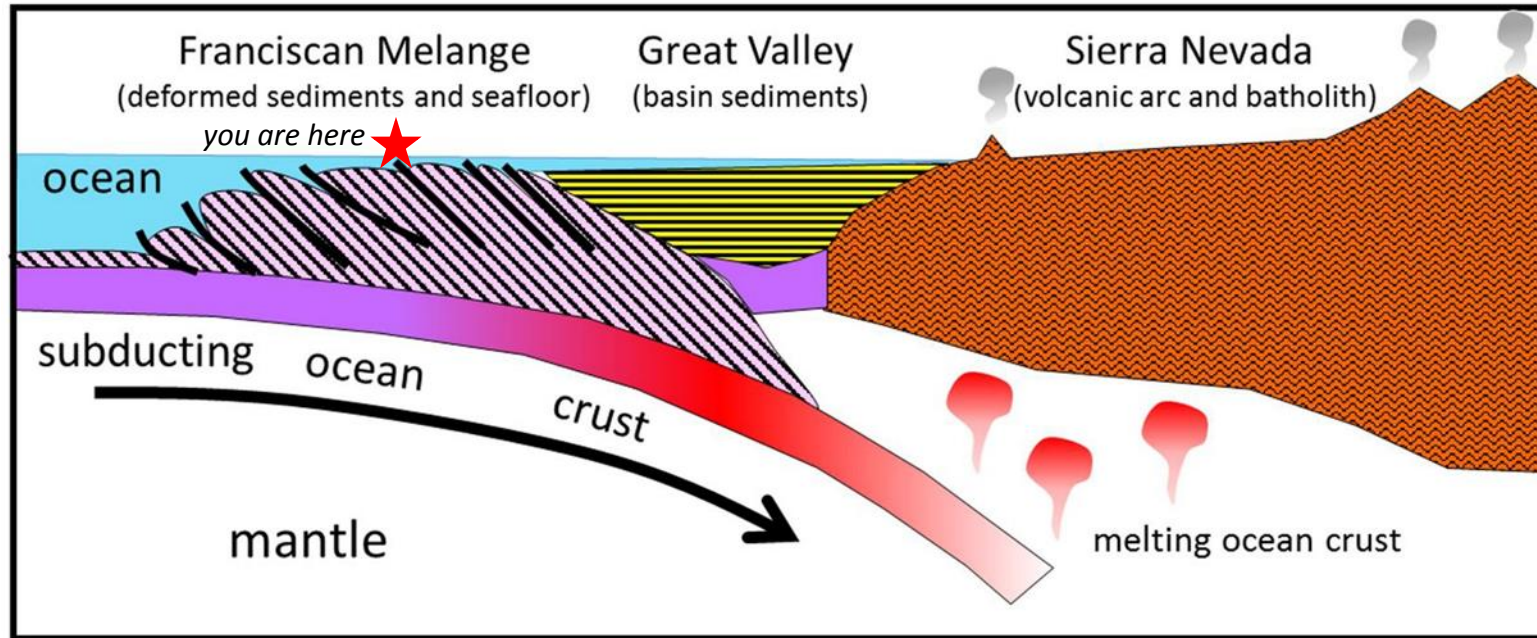


First, Some Background: Geologic Setting of the East Bay

World's Tectonic Plates



Situation in the East Bay Hills until about 25 million years ago



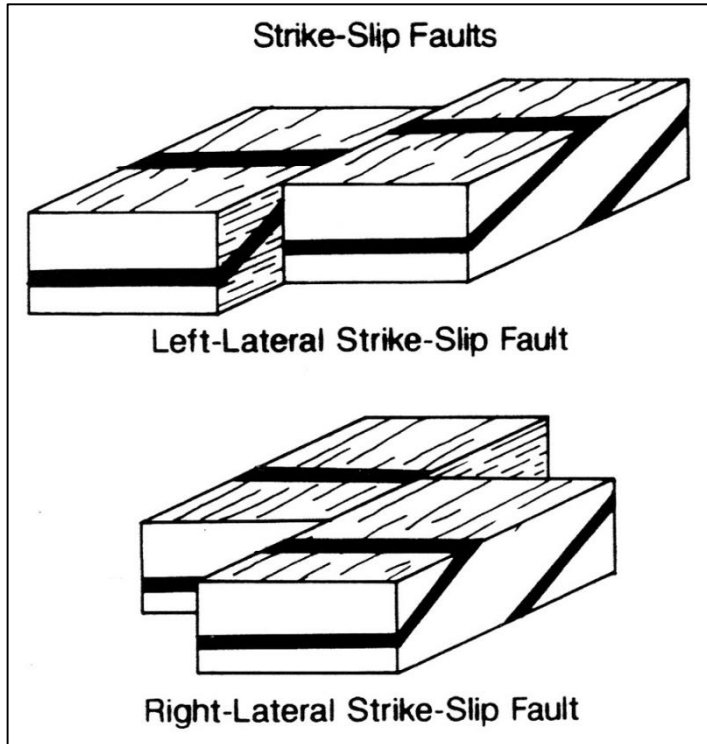
Thrust faults in the East Bay Hills moved deeply buried and metamorphosed sediments up and toward the west

Situation in the East Bay Hills since about 25 million years ago

- The Hayward Fault is a right-lateral strike-slip fault, part of the San Andreas System
- Here it's creeping about 1" every ten years
- The last large offset here was ~1705
- Total offset on the creeping strand ~ 3 miles in past 12 million years



Olive Ave.,
Richmond



View north

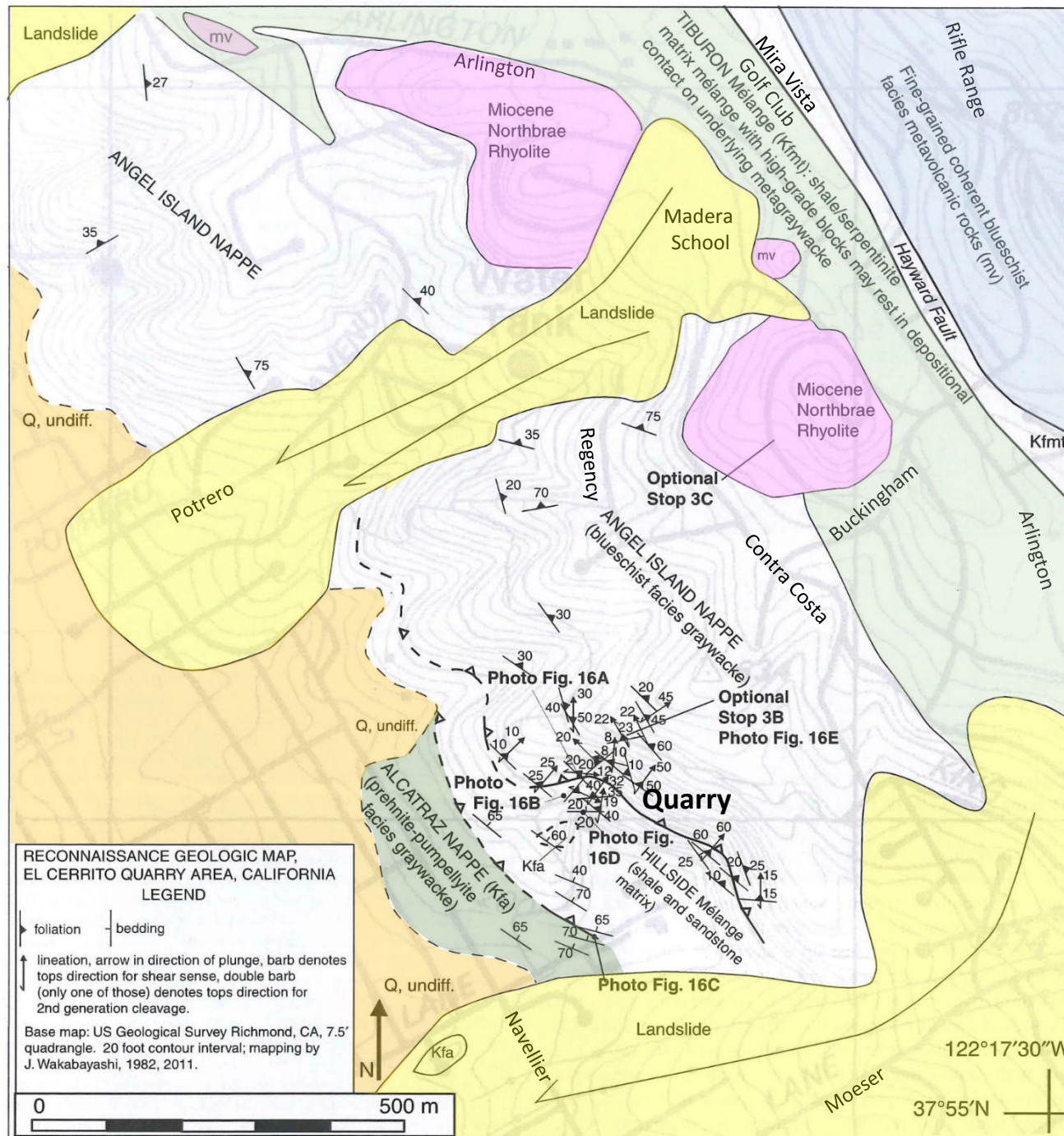


Google Earth

Local Geologic Map by John Wakabayashi

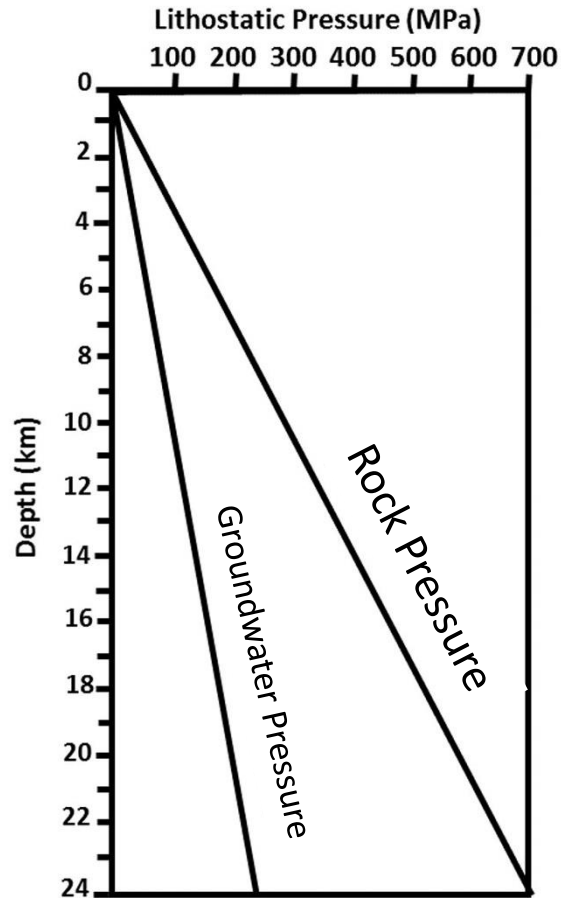
What this map tells you:

- There are four layers of old metamorphic rock
 - Blueschist (blue, highest)
 - Tiburon Melange (green)
 - Angel Island Nappe (white)
 - Alcatraz Nappe (green, lowest)
- Above these old rocks there is a lava layer, the Northbrae Rhyolite (pink)
- There are some large landslides in the Potrero and Moeser areas (yellow)
- The Hayward Fault cuts just above Arlington

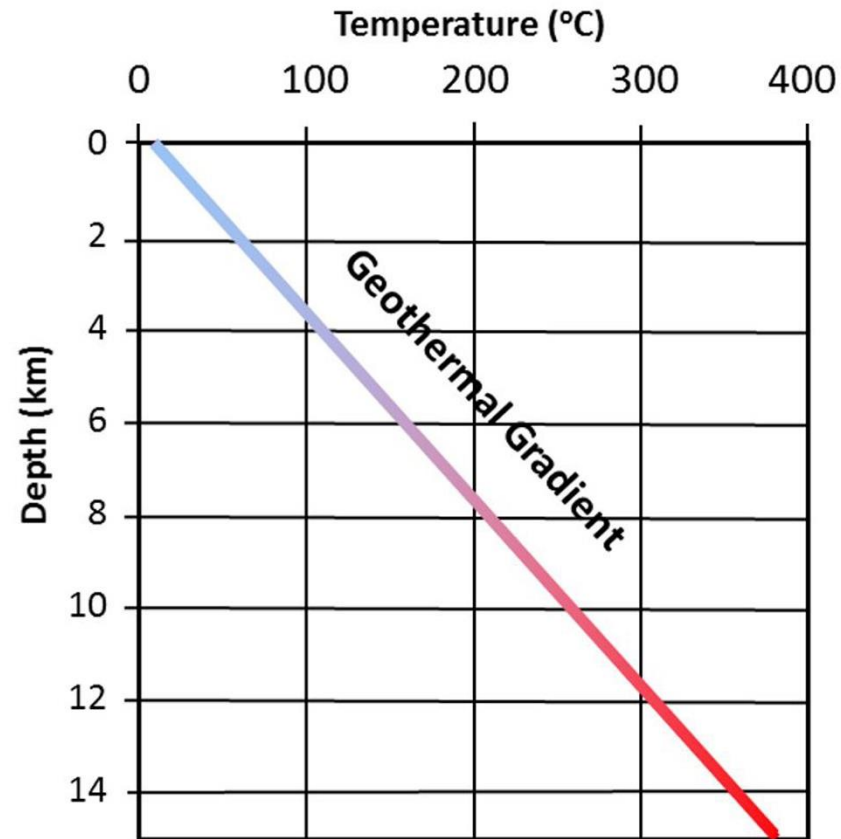


A Few Words About Metamorphic Rocks

- Metamorphic rocks have been altered by heat and pressure, mainly due to being buried deep in the earth
- Pressure increases by $\sim 24 \text{ Mpa/km}$ (1 psi/ft) as you go into the earth
- Temperature increases by 10°C/km (29°F/mi) as you go into the earth



1 MPa = 145 psi; 1 km = 0.6 mi



$1^\circ\text{C} = 1.8^\circ\text{F}$

A Few More Words ...

- Metamorphic rocks are classified by texture (slate, schist, gneiss) or by composition (blueschist, greenschist, etc)
- Most of what you see in the Hillside Nature Area is a Schist by texture, meaning it has aligned minerals, mainly mica (looks like glitter)
- Compositionally these rocks are a Blueschist (the blue color comes from the mineral glaucophane)
- Blueschist is considered a “high pressure, low temperature” metamorphic rock that forms at 15-30 km depth and 200 to 500°C
- Heat and pressure cause the original minerals in a rock to recrystallize and realign themselves

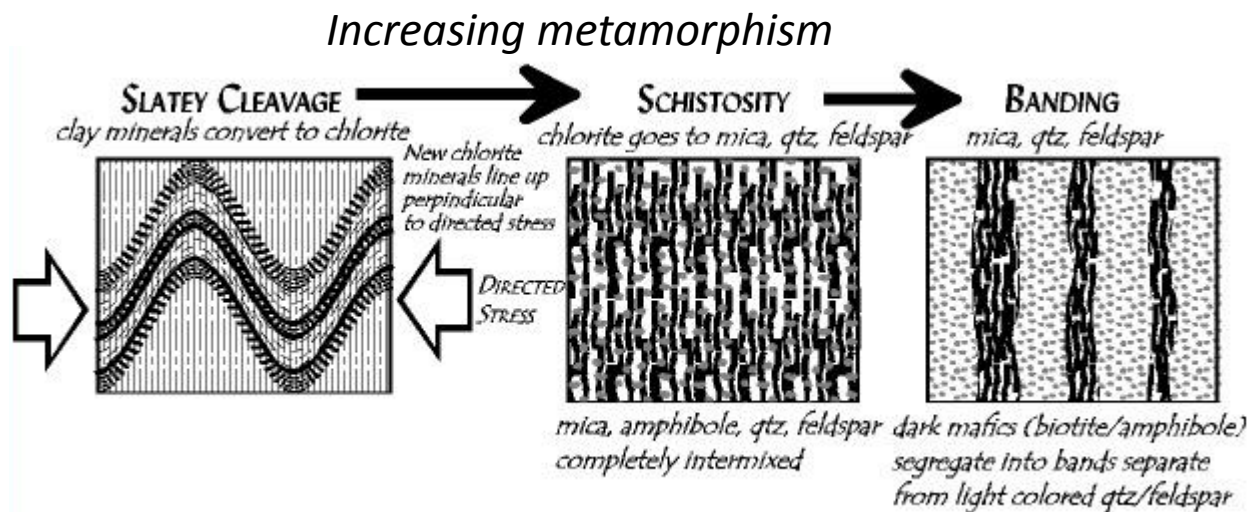
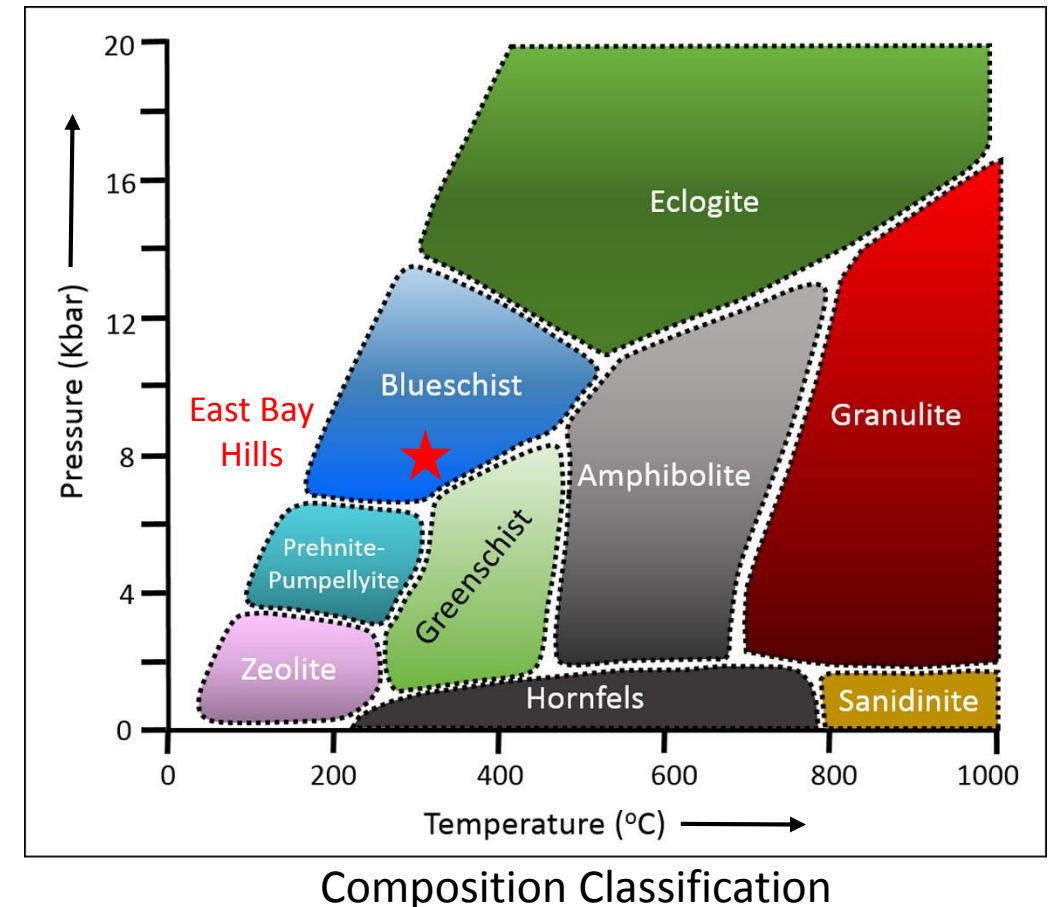


Diagram from Atlantis Online, <http://atlantisonline.smfforfree2.com/index.php?topic=1379.15>



Main Rock Types Found In The Hillside Nature Area, El Cerrito



Franciscan Assemblage (150 to 66 million years old)

Metagreywacke

Rust-colored metamorphosed dirty sandstone, probably ancient beach or near-shore deposits

Blueschist

Blue-ish rock derived from marine sediments and seafloor basalt; has compositional banding and abundant mica, but little or no primary texture such as bedding

Northbrae Rhyolite

Light-colored (quartz-rich) 11.5 million-year-old lava flow. Same unit forms Indian Rock in Berkeley. The source volcano may have been northeast of Hollister.

*"I feel the earth move under my feet...."**

Faults & Landslides

Both are suggested by scarps and springs
Landslides have hummocky expression



Spring at Regency cul-de-sac



Hayward Fault scarp on Thors Bay Drive



Small mudslide and spring
on Havens Place

*apologies to Carol King

Extra Credit: Further Reading

Local geologic maps and rocks

Graymer, R.W. 2000. Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California. US Geological Survey, <https://pubs.usgs.gov/mf/2000/2342/>

Sloan, D. 2006. Geology of the San Francisco Bay Region. University of California Press, Berkeley.

Wakabayashi, J., 1992, Nappes, tectonics of oblique plate convergence, and metamorphic evolution related to 140 million years of continuous subduction, Franciscan Complex, California: *The Journal of Geology*, v. 100, p. 19–40. doi:10.1086/629569

Wakabayashi, J., 2011, Mélanges of the Franciscan Complex, California: Diverse structural settings, evidence for sedimentary mixing, and their connection to subduction processes, in Wakabayashi, J., and Dilek, Y., eds., Mélanges: Processes of formation and societal significance, Geological Society of America Special Paper 480, p. 117–141. doi:10.1130/2011.2480(05) http://seismo.berkeley.edu/~burgmann/EPS116/labs/Lab_08_Marin/Wakabayashi_IntGeolRev_2015.pdf

Wakabayashi, J. & C.D. Rowe (2015). Whither the megathrust? Localization of largescale subduction slip along the contact of a mélange. *International Geology Review*, 57:5-8, 854-870, DOI: 10.1080/00206814.2015.1020453

The Hayward Fault

Sloan, D., Wells, D., Borchardt, G., Caulfield, J., Doolin, D.M., Eidinger, J., Gee, L.S., Graymer, R.W., Hellweg, P., Kropp, A., Lienkaemper, J., Rabamad, C., Sitar, N., Stenner, H., Tobriner, S., Tsztoo, D., and Zoback, M.L., 2006, The Hayward fault, *in* Prentice, C.S., Scotchmoor, J.G., Moores, E.M., and Kiland, J.P., eds., 1906 San Francisco Earthquake Centennial Field Guides: Field trips associated with the 100th Anniversary Conference, 18–23 April 2006, San Francisco, California: Geological Society of America Field Guide 7, p. 273–331, doi: 10.1130/2006.1906SF(17).

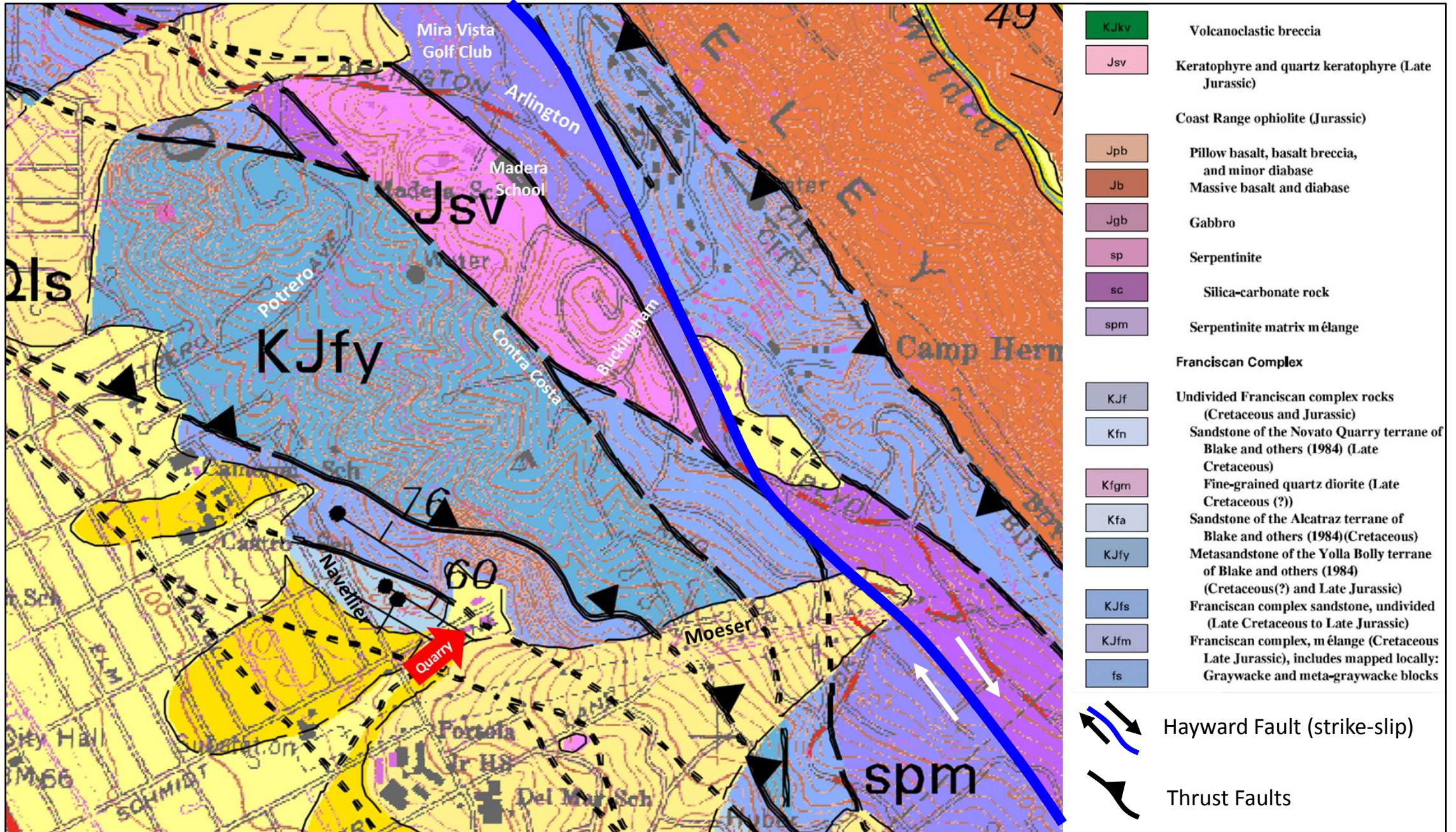
The Northbrae Rhyolite

Cardwell, R. NCGS Field Trip - The Silica Rich Rocks in the Berkeley Hills. <http://www.ncgeolsoc.org/FieldTripInfo/Northbrae%20Rhyolite%20FT.htm>

Geology for people in a hurry

Prost, G. 2018. *The Geology Companion: Essentials for Understanding the Earth*. CRC Press, Taylor and Francis Group, Boca Raton.

El Cerrito section of Geologic Map of Oakland Quadrangle, US Geological Survey



Who *is* this guy?

Gary Prost, your guide, is a retired geologist. He earned his PhD in Geology from Colorado School of Mines in 1986. He spent 40 years working for the U.S. Geological Survey, mining companies, and oil companies. He is a member of the Northern California Geological Society.

