EART120, Field Trip 1 **April 10, 2016**

The San Benito Gravels: Depositional Systems, Paleocurrents, and Provenance

Introduction

The San Benito Gravels (**SBG**) consists of a 500 m-thick succession of Plio-Pleistocene sands and gravels. These deposits are exposed in the Paicines syncline in the southern Santa Clara Valley, in San Benito County, covering an area of approximately 500 km^2. Sediments accumulated in response to the uplift of both the Diablo Range to the east and the Gabilan range to the west (see map) and lie unconformably upon marine sediments in several areas within the valley.

The SBG are contemporaneous with gravels found in a roughly north-south trend through central California, including the Livermore gravels and the Paso Robles gravels. The deposits are evidence of the change from marine to terrestrial conditions experienced by large areas of the Great Valley geologic province during late Pliocene and early Pleistocene time. In addition, the successive appearance of various rock types and the paleocurrent directions indicated by structures within the SBG can indicate source areas and uplift processes associated with the deposition of the SBG.

Summary

The purpose of this exercise is to provide you with first-hand experience in applying sedimentologic and stratigraphic field techniques. The primary scientific goal is to determine the facies and depositional environments of a succession at Stop 2. This includes the general orientation of the beds and depositional environment (and processes). You will collect paleocurrent data and clast counts to interpret transport and provenance.

Field Trip Assignment

Today you will:

1. consider the vertical lithologic sequence, identify, and measure stratigraphic units,
2. measure crossbeds for paleocurrent information,
3. identify clast compositions for lithologic and provenance information.

As always, take careful notes: you never know what information you will need for interpretations once you are away from the field area.

Next week in lab you will learn how to plot your paleocurrent measurements on stereonets, correct your data for tectonic tilting of the outcrops, and ultimately integrate your paleocurrent results with your provenance data and the locations of the known source areas.

The observations and measurements to be made today are listed below. Field methods will be demonstrated first at stop 2, for those who need instruction or want a refresher on Brunton or

Jacob staff use (note that three dimensions of a bed are needed to get an accurate reading of strike and dip). You will work in teams of two but each team member should keep accurate notes of the team's findings, because you will be required to write a summary of your findings, to be turned in as an extended abstract. You will be using your own data in lab next week, so be sure to take careful measurements. Also, be careful not to destroy the structures at the outcrops, so that your colleagues also can collect data.

Field Trip Stops:

Stop 1. ~3.8 miles east of Hwy 25 on Panoche Rd, Tres Piños River.

Take note of the distribution of bar deposits; examine the sedimentary structures and grain sizes, shapes, orientations, and compositions; and classify the river as braided or meandering. You will not include this information in your report, but it is useful context and will be used in lab.

Stop 2. 4.7 miles east of Hwy 25 on Panoche Rd., roadcut on both sides of the road.

Collect the following data:

(1) Lithologies & Stratigraphic Column:

a. First roughly sketch the northern outcrop, showing the sedimentary units that are present. Also note any large-scale bedforms, bed geometry, or other features.
b. Measure the strike & dip of the bedding. You will use this information with your Jacob staff to measure the section, and for paleocurrent analysis.
c. You will then use the Jacob staff to measure the thicknesses of each unit.
d. Note all relevant sedimentary features that you will need for description of the facies and interpretation of the depositional environment. At a minimum, you should note sediment composition, presence/absence of matrix, grain size, sorting, rounding, sedimentary structures, typical bed thicknesses, contacts between beds within the units, and contacts between larger units.

(2) Paleocurrents

Measure at least **15 crossbed sets** for the orientation of the cross-laminations. Note whether the sets are planar-tabular or trough crossbeds. If planar, measure the strike and dip of the foreset surface. If trough cross-stratified, measure the trend and plunge of the trough axis, as the dip direction of the crossbeds on the flanks of the trough will not indicate the paleocurrent direction correctly. Note the stratigraphic position within your vertical section of each measurement.

(3) Clasts

Identify at least **30 clasts** chosen at random, using a line-intercept method (place your Jacob staff flat on the outcrop face and identify the clast found at each of the 10 cm paint increments). For the purposes of this exercise, identify the clasts using the following general categories:

- *plutonic rocks*
- *high-grade metamorphic rocks (schist, gneiss, marble, blueschist)*

- *low-grade metamorphic rocks (greenstone, graywackes)*
- *volcanics*
- *chert*
- *unmetamorphosed sedimentary rocks*
- *ultramafics (e.g., serpentine)*

Abstract Assignment

Your abstract will provide an interpretation of the outcrop (stop #2) data in light of your understanding of sedimentary processes and the geologic history of the region. More specifically, your abstract must explain the nature of the field site (e.g. location, age, relevant background information for your interpretations), the purpose of your work (related to a broader unsolved geological problem) and goal of your study, methods, results of data collection and analysis, and interpretation of the depositional facies, paleocurrent analysis, and clast provenance. You should also provide a broader interpretation relating your interpreted facies succession to changes in base level.

For this assignment, you will submit an extended abstract, with a word limit of 400 words. Include the total word count at the end of your abstract. Along with the abstract, you will turn in a stratigraphic column showing beds, sedimentary textures/structures, and general lithology. The column should follow the guidelines set forth in the handout that will be provided in class. Don't forget to list your field partner on your abstract and column.

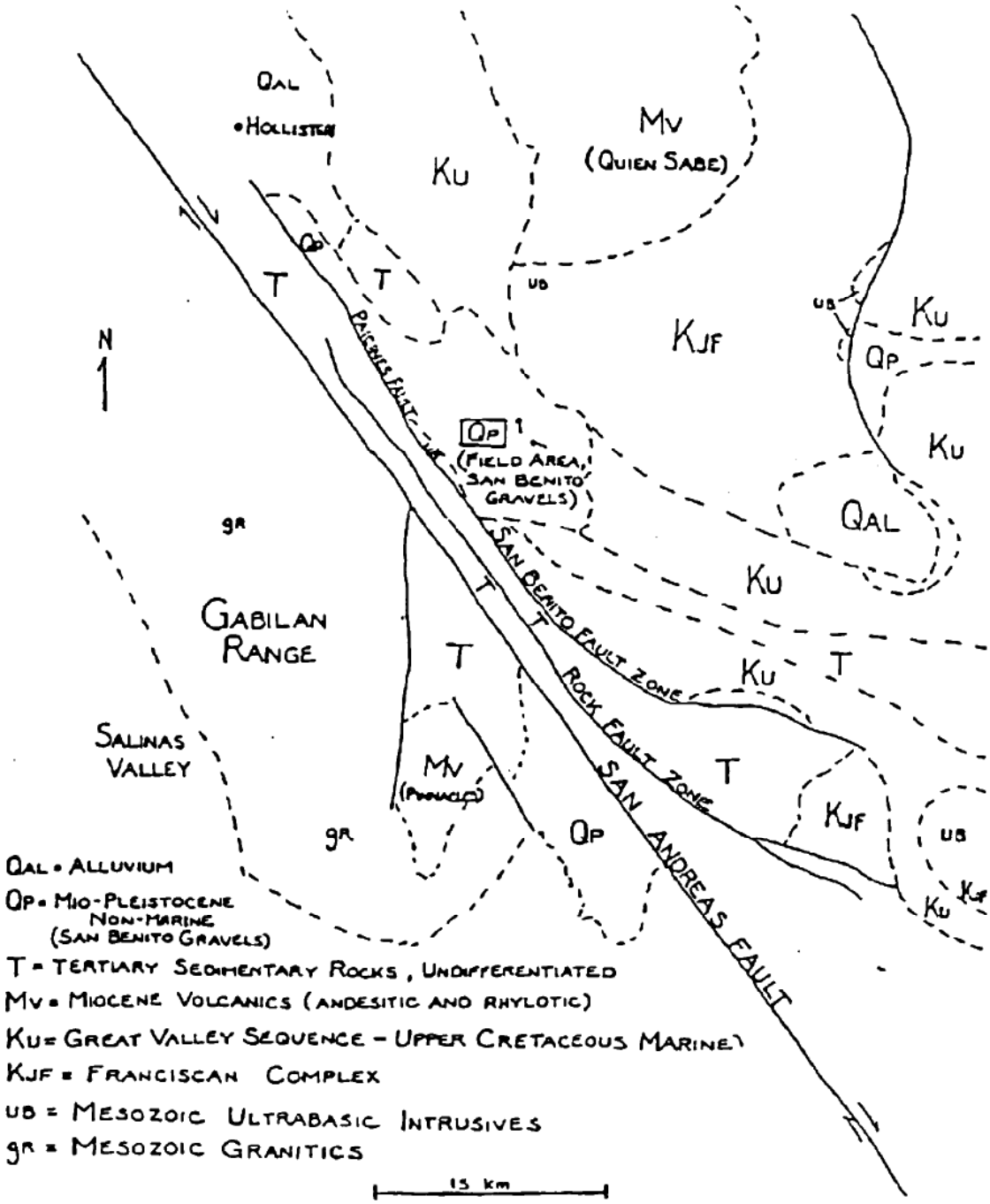
First draft of your abstract by noon on Monday, April 18. Your draft should be complete and polished. All electronic material should be submitted to your drop box at eCommons. Please submit your abstract in one of these formats: Word, Open Document, or pdf (if you use Pages, save it as a pdf).

I will schedule individual meetings on April 19 (and 20, if necessary) to discuss the draft with you.

The final, revised version of your abstract, as well as the stratigraphic column, are due by the start of class on April 22. The abstract should be submitted at eCommons and the hard-copy section material turned in at class (or to my office A208 or mailbox in A234 before class).

Conglomerate Clast Lithologies from the San Benito Gravels

Quien Sabe Volcanics: rhyolite, dacite
Salinian block: marble, quartzite (vein?), granite
Franciscan: sandstone, chert, chert conglomerate, graywacke, shale, serpentine, basalt, blueschist
Gabilans: rhyolite, marble
Undifferential Tertiary rocks: siliceous mudstone, conglomeratic sandstone, arkosic sandstone



Road Map


MAPQUEST
Twin Creeks
Madrone
Morgan Hill
Henry Coe State Park
0 5mi
5km
Sveadal
Santa Clara
Santa Cruz
Santa Clara
Merced
101
152
Lonoke
Gilroy
Corralitos
Aptos
Carnadero
Old Gilroy
San Felipe
Miller
Santa Clara
San Benito
Dunneville
Freedom
Corporal
1
Watsonville
Ellicott
129
Chittenden
Hudner
Oaks
156
Aromas
Las Lomas
Hollister
San Juan Bautista
Santa Cruz
Monterey
Elkhorn
San Benito
Monterey
Morse
Union Rd.
Merced
San Benito
Moss Landing
G12
Tres Pinos
Monterey Bay
Prunedale
25
Gabilan Acres
Bolsa Knolls
Paicines
Nashua
Cooper
Santa Rita
Stop 1
Stop 2
Marina
Blanco
Salinas
G17
East Garrison
Spreckels Junction
J1
a.k.a.
Panoche Rd.
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MAPQUEST
0 1mi
1km
Cottage Corners
Bolsa Rd
Fairview Rd
San Juan Rd
4th St
Hollister
Tres Pinos Rd
Union Rd.
Union Rd.
Ridgemark Golf And Country Club
Tres Pinos
Airline Hwy
Hollister Hills St Vehicular Park
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