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A field-based exploratory acitivty to introduce sedimentary rocks

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Introduction

Exploration of sedimentary processes in the field provides a context for new concepts that the classroom lacks. At a community college, most students are already familiar with (and curious about) the surrounding landscape. Many are also "science-phobic." In an introductory geology class, field activities offer students the opportunity to learn new concepts by studying familiar areas, drawing on their natural curiosity and lessening their fear. As an introduction to sedimentary rocks and processes, students are guided through a two-stage field laboratory in a local canyon, the Farmington Glade. This lab is highly adaptable to other locations and environments.

Learning goals

- Gain **content knowledge** about sedimentary processes and how processes relate to rock types
- Develop **skills in observing and measuring** features of sediments and sedimentary rocks
- Exercise **deductive reasoning** to draw conclusions based on observations and measurements
- Gain **confidence** in ability to understand science

Part 1: Examining sediments

Sediments in side drainage entering the Glade

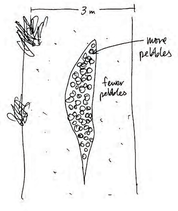
SOURCE: unknown

TRANSPORT: intermittant stream

DEPOSITIONAL ENVIRONMENT: dry wash

To characterize the deposit and to determine the source, students examine
1. Sorting (by using sieves)
2. Lateral variation in grain size
3. Rounding
4. Composition of the clasts

EARLY HYPOTHESIS:
source is the surrounding cliffs

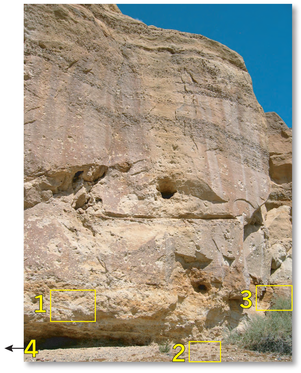


Sample sketch showing lateral variation of grain size in the streambed

Sediments are:
1. Moderately sorted (mostly sand)
2. Subangular to subrounded
3. Mostly quartz and feldspar
4. some iron oxide staining

Part 2: Examining rocks

Ojo Alamo Formation (Tertiary)



What type of rock makes up the Ojo Alamo Formation?
Is it the source of the sediments in the wash?
What was the depositional environment?
What was the method of transport?
What was the source of the sediment?
What else can we find out about the area during the time of deposition?

OBSERVATION
Rocks that make up the cliffs are composed of coarse sand and cobbles

CONCLUSION
Rock type = Sandstone and conglomerate

OBSERVATION
The sand grains are subangular, composed of quartz and feldspar

CONCLUSION
These rocks are the most likely source for the sediment in the wash.

OBSERVATION
Cobbles have eroded out of the cliff, are more resistant to weathering, and consist mostly of pink metamorphic quartzite

CONCLUSION
Source for cobbles is not local, most likely the San Juan Mntns ~60 miles to NE

OBSERVATION
Cobbles occur in lenses throughout the cliff

CONCLUSION
Deposited in high energy environment, most likely in river channels

OBSERVATION
Cross-beds are abundant in the sandstone

CONCLUSION
Sand was deposited in an environment with directional flow, also supports river hypothesis based on cobbles

OBSERVATION
Direction of cross-beds is consistent around the outcrop

CONCLUSION
They couldtell us which direction the river was flowing if we wanted to measure enough of them

OBSERVATION
The Ojo Alamo Formation contains numerous large logs of petrified wood. The logs are much bigger than anything that grows in the area today.

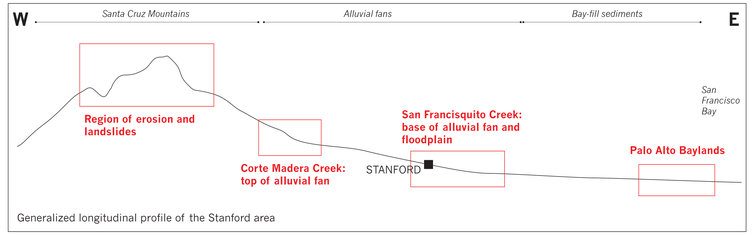
CONCLUSION
Two possibilities:
1. The rivers carried the logs down from the mountains and deposited them here
2. The climate has changed dramatically since these sediments were deposited

SOURCE → **TRANSPORT** → **DEPOSIT**
San Juan Mountains — *very large rivers* — *in the streambed*

Same idea, different place

PROBLEMS
1. Larger number of students in the class (40)
2. No easily accessible outcrops of sedimentary rocks
3. Limited number of non-concrete streams in short driving distance

SOLUTIONS
1. Send students out in small groups to different sedimentary environments
2. Collect samples so students can share different areas
3. Look at rocks back in the classroom



Generalized longitudinal profile of the Stanford area

Students measure stream velocity and measure cobbles at Corte Madera Creek

Students collect a core from the Palo Alto Baylands

Measuring the five largest clasts in a 1 m square area

Sample collected from the landslide site

Students educate each other about the different environments they've been to, focusing on quantifiable aspects:
- rounding
- sorting
- composition of clasts
- any additional characteristics (mudcracks, imbrication, plant life)

TAs help students connect sediment samples to rock types: sandstone, conglomerate, breccia, mudstone.

Still in process! Stay tuned for the results!

The results of sieving the dried landslide sample