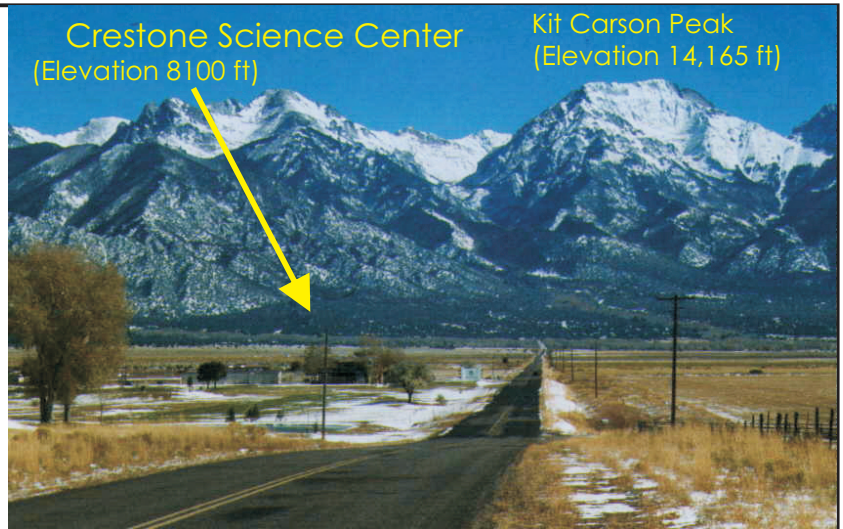


# FIELD METHODS IN NEOTECTONICS AND PALEOSEISMOLOGY

*A 9-day summer Field Course, offered by the Crestone Science Center*

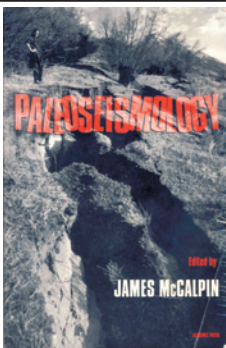


WHERE: Crestone, Colorado      WHEN: May 21-30, 2012  
INSTRUCTOR: Jim McCalpin (Editor, "Paleoseismology")

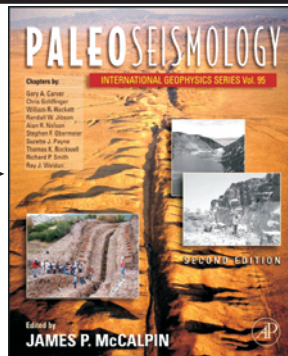
## 2012 marks the 12th Anniversary of the Field Course!

The science of Paleoseismology is difficult to master from only classroom lectures. It is basically a **field science**, but with specialized techniques not covered in a regular university Geology Field Camp.

This course teaches the latest field techniques, but also contains evening lectures covering the entire field of Paleoseismology.



1996



2009

Lectures are based on the 2nd Edition of "Paleoseismology", which has been the international standard reference work since 1996. It was completely updated in 2009 by Dr. McCalpin.

### Field Mapping



### Trenching & Logging



### GIS & Computer Graphics

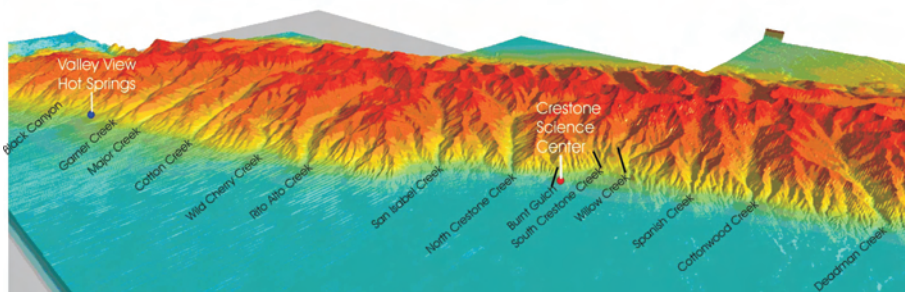


**Program:** Part 1 emphasizes photogeologic fault mapping, Quaternary geologic mapping, and tectonic geomorphology. After 2 days of basic instruction, each participant performs a 2-day Mini-Project that involves large-scale mapping an area of the Sangre de Cristo fault zone near Crestone. This fault zone is a typical Neogene Basin-and-Range normal fault, and displays complex fault scarps in Quaternary alluvial fans and moraines at the base of the rugged 2000 m-high range front.

Part 2 emphasizes detailed site studies such as trenching, soil profile description, and sampling for various dating techniques. Participants will log the walls of backhoe trenches excavated across the Sangre de Cristo fault, and will learn the philosophy of trench siting, excavation logistics, manual and digital logging techniques, as well as various schemes for defining trench mapping units.

## NEOTECTONICS

The expression of neotectonics in the field is highly dependent on the style of deformation and the rate. In this course, you will see the expression of normal-fault block uplift at a rate of 0.1-0.3 mm/yr



## GEOMORPHIC METHODS

### STEREO AIRPHOTOS, FIELD MAPPING

There is no substitute for learning to map paleoseismic landforms in the field, using stereo airphotos. This is the bread-and-butter of field work on which all later analysis depends. If you can make a good map, you will be a good paleoseismologist



### OTHER FANCY TECHNIQUES

Field methods unique to paleoseismic studies include fault scarp profiling, and creation of ultra-large-scale topographic maps showing paleoseismic landforms (right). Such maps illustrate the morphology formed by recurrent faulting events on the same fault strand (far right).

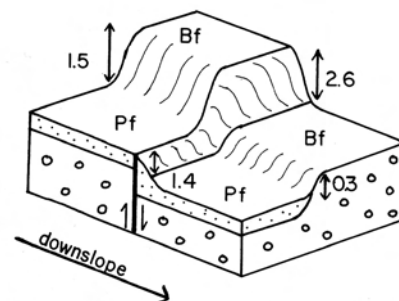
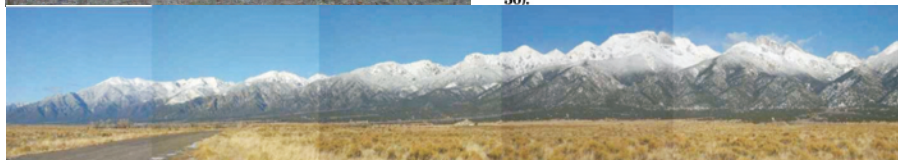


Figure 56.—Geometry of fault scarp and alluvial terraces at scarp profiles C1 and IV, VGFZ (location is on figure 50).



# TRENCHING & LOGGING

CSC maintains the only permanently-open paleoseismic trench in North America, which has been used since 2001 for teaching purposes. The trench is across a strand of the Sangre de Cristo fault zone in the Rio Grande rift zone, a continental normal fault.

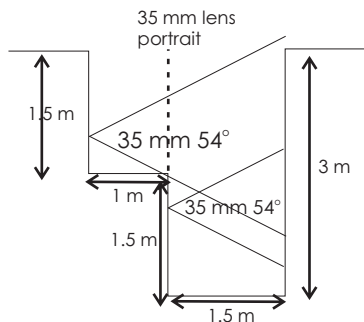


## LEARNING TO CLEAN AND TO MARK THE CONTACTS

Every paleoseismologist needs to practice cleaning trench walls, because the style & efficiency of cleaning determines what features are visible. You cannot map features if you cannot see them! Your marked contacts form the basis for all interpretation.

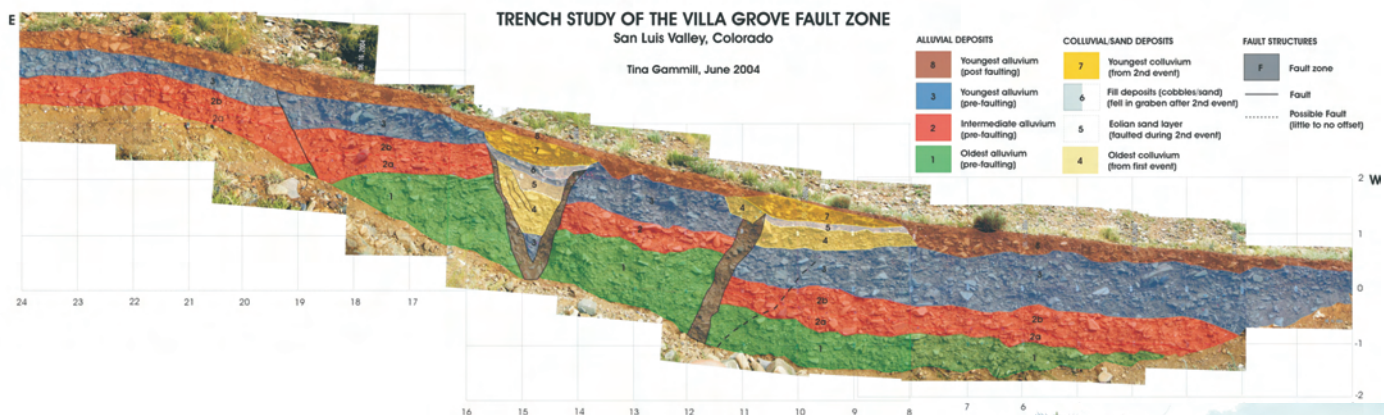
## LEARNING TO GRID THE WALL & PHOTOGRAPH

After the wall is cleaned and all the geologic contacts are marked, you need to erect a string grid on the wall. Methods range from the quick-and-dirty to the rigorous, all of which are taught. Next comes photographing the wall with your digital camera, and rectifying the photos into a mosaic (Photoshop).



## LEARNING TO LOG

Participants will learn manual logging and digital photomosaic logging. The former is the basic method that any paleoseismologist must know; it's cheap and it works anywhere. The latter is the current research standard, and permits many variations in the style of final presentation of the trench log (see the student example below from the 2004 course).

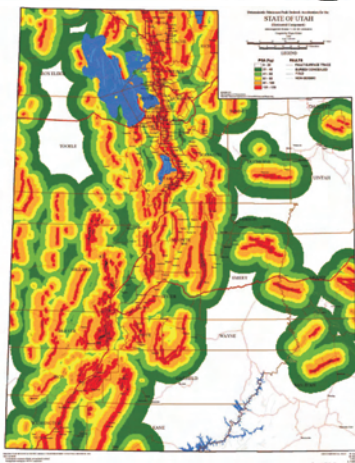
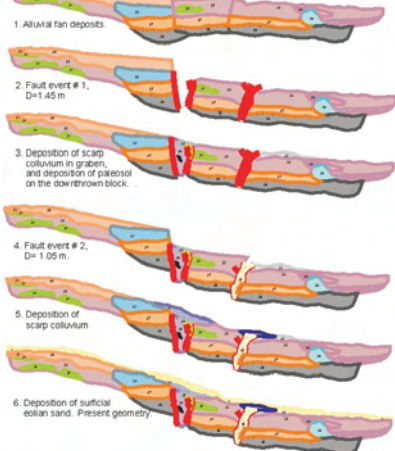


## LEARNING WHAT AND HOW TO SAMPLE

To date a paleoearthquake you have to identify "earthquake horizons" and collect dating samples that bracket them as tightly as possible. Techniques for collecting radiocarbon, TL, and OSL samples are all slightly different. Your final geochronologic control from a trench will depend on how well you perform these steps.



**Retrodeformation Sequence**



**HOW PALEOSEISMIC DATA ARE USED IN SEISMIC HAZARD ANALYSES (Deterministic and Probabilistic)**

The goal of paleoseismic studies to derive the magnitude and timing of prehistoric earthquakes, for input into seismic hazard analyses. We discuss how paleoseismic data is used to structure the logic trees in PSHA, and how the uncertainties from field data are translated into branches on the logic tree. Doing this requires an understanding measurement error and temporal variability.

*IT'S NOT ALL WORK; THERE IS SOME FUN TOO....*

*From the initial "weigh-in" to loading your car to leave, there are always a few light moments. The middle Sunday is a day off, so feel free to visit nearby attractions such as the Great Sand Dunes National Park and the 14,000 ft-high peaks of the Sangre de Cristo Wilderness. You might even get to drive the Army troop carrier on our trips to the field (in case you missed out on this when you were 18).....*



*Thanks to Chef Shawn, we have never yet had an attendee lose weight during the two weeks. The food is just too good. Not to mention the deserts like the pie shown below.*

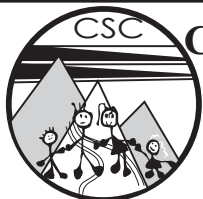
**The Weigh-In**



**Putting On the Pounds (kilos too...)**



**REGISTRATION AND FEES:** The 9-day course costs \$1995, which includes all instruction, in-field transportation, materials/supplies, lodging, and meals. A 25% deposit is required by April 28. For students who prefer to camp out, fees are reduced. Registrants bring their own basic personal field equipment (compass, GPS, digital camera) and a laptop, preferably with some computer graphics and GIS software. We recommend that you bring a copy of the book "Paleoseismology, 2nd Ed." for the evening lectures..



**Crestone Science Center, Inc.**

*Education and Research  
in the Earth Sciences*

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