

UC SANTA BARBARA

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## **MOUNTAINS ON THE MOVE: GEOLOGISTS STUDY ACTIVE FAULT IN WYOMING'S GRAND TETON NATIONAL PARK**

(Jackson Hole, Wyo.) A team of geologists arrives in Jackson Hole, Wyo. this week to continue studies of the movement of mountains.

"Are the Tetons getting higher? Or is Jackson Hole getting lower?" asks Arthur Sylvester, professor of geology at the University of California, Santa Barbara. "These are the questions we seek to answer during our survey of the Teton fault this summer."

The Teton fault, one of the largest active faults in Wyoming, is responsible for the uplift of the magnificent Teton Range in Grand Teton National Park over the last eight million years, according to Sylvester. Since 1988, UC Santa Barbara teams have been searching for minor fault movement, or "creep," along a 20 mile line of permanent bench marks across the park from the Snake River into colorful Cascade Canyon.

By comparing results of repeated precise leveling surveys of the bench marks, the California geologists seek to determine if the Teton Range is slowly but inexorably rising by minor, vertical displacement across the fault movement without the usual

earthquake activity.

The initial leveling survey was done in 1988 by Sylvester and his students in cooperation with researchers Robert B. Smith, professor of geology, and his graduate student, John Byrd, both from the University of Utah.

Subsequent resurveys were done in 1989, 1991, 1993, and 1997 by Sylvester with UCSB and Utah undergraduate students.

Sylvester will also be assisted by Christopher Hitchcock, a UCSB graduate and who is now senior project geologist for William Lettis & Associates.

This summer's surveying team includes several undergraduate students from UCSB and UC Davis, a retired civil engineer, a retired US Navy officer, an Oklahoma State University graduate student in geology, a professional writer, and a high school science teacher. These volunteers signed up through the University Research Expeditions Program (UREP) in Berkeley, Calif.

Sylvester found that, between 1988 and 1991, the valley east of the fault (Jackson Hole) rose ten millimeters relative to the Teton Range. This was probably due to the rise of the water table caused by refilling Jackson Lake, eight kilometers north of the leveling line. Additionally, the valley tilted toward the mountains.

However, between 1991 and 1993, to Sylvester's surprise, measurements indicated that the valley tilted slightly eastward, away from the Teton Range. This is contrary to the long range tectonic tilt inferred from the slope of the valley floor and from its subsurface strata.

At first Sylvester and Smith postulated that the uplift and tilting was caused by raising and lowering of the water table due to the relatively rapid draining and filling of Jackson Lake.

But the 1997 survey results resembled those of the 1989 and 1991 surveys, and the uplift of the valley near the fault increased another eight millimeters.

The uplift of the valley, instead of the mountains, implies that the Teton fault is back-slipping in response to regional crustal shortening. Global Positioning System satellite measurements that Smith has acquired in both Grand Teton and Yellowstone National Parks in the past decade support this hypothesis.

To test the hypothesis, Sylvester and his UCSB students extended the line of bench marks across the Snake River to the Gros Ventre Mountains east of Jackson Hole.

Thus the 2001 and future surveys of the line, now 26 miles long, will monitor not only the behavior of the Teton fault relative to the adjacent valley, but also of the valley to the mountains on each side.

In the event of a major earthquake on the fault, numerical modeling of resulting displacements will allow Sylvester and Smith to map the shape of the fault to a depth of about ten miles. Sylvester said this is a matter of great interest, dispute and concern, given the existence of little data at present for this and other major faults in the western deserts and mountains.

Previous surveys have been supported by the National Science Foundation, the National Earthquake Hazards Reduction Program, the National Park Service, and the Teton Science School.

Editors: To access Arthur Sylvester's web page visit:

<http://www.geol.ucsb.edu/faculty/sylvester/>

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