

Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Active Faults and Seismic Hazards to Infrastructure at Great Sands Dunes National Monument and Preserve
Type of Project: Research
Funding Agency: National Park Service, RM-CESU
Effective Dates: June 1, 2002 - April 30, 2003
Funding Amount: \$9447
Investigators and Agency Representative: James P. McCalpin, Utah State University, 719-256-5227, mccalpin@geohaz.com NPS CONTACT: Andrew Valdez, Great Sand Dunes NM&P, 719-378-2312 (X204), Andrew.Valdez@nps.gov
Project Abstract: The main goal of this project is to characterize the recent displacement history of fault scarps near GRSA facilities via paleoseismic trenching of fault scarps. Paleoseismic trenching and interpretation will follow standard methods. At least two trenches are envisioned. Trench 1 will be excavated on the prominent scarp adjacent to the Visitor Center. Trench 2 will be excavated near the water supply tanks upslope from Headquarters. A major goal of trenching is to precisely date paleoearthquakes to determine which of the multiple fault traces at GRSA have experienced the most recent displacement, and thus pose more hazard to facilities. (Note that 60% of the budget is devoted to dating services). The major geochronologic question is whether paleo-surface ruptures at GRSA date so closely to the paleoearthquakes to the north and south that a >65 km-long rupture can be substantiated. The rupture length and displacement observed in trenches will be used to estimate the magnitude of past earthquakes at GRSA, based on standard methods. The mapped fault traces will be transferred to the GRSA digital (GIS) map database. Based on the style of near-surface rupturing exposed in trenches, zones of potential surface faulting will be identified around each mapped fault trace. Within these zones, no future building should take place without a prior trenching study to "clear" the site. The final report will be delivered to the Superintendent of GRSA at the end of the project, along with new contributions to the geologic map of the GRSA. At that time, we will consult on how to translate the scientific results into visitor displays. At a minimum, we will contribute large color graphics to NPS for production of a static display with a fault map, typical trench log, photograph of geologists logging a trench, and a paragraph summarizing the seismic setting of the GRSA. In addition, we will produce a short video showing excavation of the trenches, wall cleaning and gridding, geologists at work mapping the trench walls, and a voice-over narration explaining how the trenching is used to reconstruct past earthquakes and plan for future ones.
Outcomes with completion dates: Final Technical Report on the activity and hazard posed by the two trenched fault strands. Report will be provided in hard copy and on CD-ROM, and will include digital trench maps. Instructional video showing how fault trenching studies are used to assess earthquake hazards, and what those hazards might be for GRSA.
Preliminary Report: Please see page 2.
Keywords: Great Sands Dunes National Monument and Preserve, paleoearthquakes, seismic monitoring
<u>For Administrative use only:</u> <i>Date Annual Report Received:</i> <i>Date Final Report Received:</i> <i>Publications, etc. on file:</i>

Active Faults and Seismic Hazards to Infrastructure at Great Sands Dunes National Monument and Preserve: Preliminary Report

1. Purpose of the Project: To identify potential hazards to infrastructure from future earthquakes on the active Sangre de Cristo fault, which runs through GRSA and very close to several facilities. This is accomplished by mapping active fault traces and analyzing the potential effects of future earthquake surface rupture and ground shaking.

2. Accomplishments: 1) Excavated three backhoe trenches across strands of the Sangre de Cristo fault east of the employee housing area, and near to its water storage tanks.
2) Photographed and mapped trench walls, and collected samples for dating prehistoric earthquake events.

Related Efforts/ Leverage: The faults strands were mapped and trenched as part of a field course in geology offered by the Crestone Science Center (Crestone, CO) and Utah State University (Logan, UT). The PI was assisted by 9 students who used this experience as part of their course work. Their labor constituted an in-kind contribution of several thousand dollars.

3. Products: The Final Report on the trenching study and its implications for earthquake hazards will be finished in Feb. 2003. A video will also be finished at about that time.

4. Contribution to Park: Understanding the potential earthquake hazards at GRSA will permit safer planning for future infrastructure, and may point out sensitive facilities that should be retrofitted. The video will demonstrate how recurrent faulting along the Sangre de Cristo fault created the topographic barrier of the Sangre de Cristo Mountains, which in turn trapped the sand that formed the Great Sand Dunes. Past interpretive displays on geology have tended to underplay the tectonic setting of GRSA in favor of its dune dynamics and active geomorphic systems, so this will explain the “Bigger Picture” to visitors.

5. PHOTOS: see below



May 2002 - Utah State University geology field trip visits the seismic trenches at Great Sand Dunes National Monument and Preserve.



Dr. James McCalpin explains the findings of the seismic trenching at Great Sand Dunes National Monument and Preserve.