Earthquake scientists go to Himalayas for seismic research

May 5 2015

University of Nevada, Reno doctoral students Ian Pierce, right, and Steve Angster prepare for a research expedition to the Himalaya mountains to study the Himalayan Frontal Thrust Fault south of Kathmandu. They are graduate students of College of Science Professor Steve Wesnousky, who has been studying earthquakes and seismicity in that region since 1999 as director of the University's Center for Neotectonic Studies. Credit: Mike Wolterbeek, University of Nevada, Reno.

Scientists have been trying to make sense of out of what makes the earth move for centuries. The earthquake disaster in Nepal on April 25 brings attention to human frailty in the face of Mother Nature. In spite of and because of these disasters, scientists continue to work to solve the geologic and seismic puzzles around the globe.

Steve Wesnousky, a geologist and professor at the University of Nevada, Reno, has been studying the Himalayan Frontal Thrust Fault since 1999. On sabbatical to further his National Science Foundation research on the hundreds-of-miles-long fault, he was in India about three months ago studying the Earth's movement in the Himalayan foothills. He left his research site to tour through Saudi Arabia and Italy and was on his way to Paris when he heard the news of the tragedy. He started making plans to complete his return to Nepal and India as soon as travel restrictions would allow access to scientists.

Wesnousky, director of the University's Center for Neotectonic Studies, arrived in Kathmandu Sunday, May 3, and will meet up with his two graduate students on Wednesday to continue his studies to better understand the seismic hazard along one of the longest earthquake faults that affects one of the most populous areas of the Earth. The two students, Ian Pierce and Steve Angster, are in route to Nepal today.

"This is a rather unique window to understand what the surface rupture from a magnitude 7.8 thrust might look like 'fresh,' so one can then attempt to understand how that's expressed in a trench looking at paleoearthquakes," Graham Kent, geoscientist and director of the Nevada Seismological Laboratory, said. "This is also a perfect opportunity to gauge the deformation associated with large thrust faults in the greater Los Angeles basin that are thought to peg out around magnitude 7.8 to 8.1."

"No one knows for sure if there is a ground rupture yet, that's what they'll be looking for," Kent said. "For there to be no ground rupture in a magnitude 7.8 is significant for how we characterize these faults and the associated hazards."

To be certain, there has been intensive study in the past week of the area using geodesy and InSAR, a type of radar, to measure deformation and uplift of the plates. No surface ruptures have yet been found.

"Geophysics, InSAR, is pretty clear there are no clear discontinuities," Wesnousky said. "That doesn't say there cannot be surprises, so we look."

The world's highest mountain chain is the result of collision of the Indian Plate into the Eurasian Plate, causing uplift of the Himalaya mountains as the result of repeated earthquakes along the southern front of the mountain range, which extends across both India and Nepal. Wesnousky, a geoscientist in the College of Science's Department of Geology and a member of the Nevada Seismological Laboratory, centers on the foothills south of Kathmandu, just over the border in India.

Wesnousky and colleagues have conducted paleoseismic studies to define both the timing and magnitude of prehistoric earthquakes along the Himalayan Frontal Thrust Fault. Wesnousky has six peer-reviewed scientific papers about the Himalayan fault. The observations are working to define the seismic hazard of the region as well as the mechanics of fault rupture along major thrust faults.

"This is a massive subduction zone that had a large earthquake in the 1930s," Kent said. "Just to the west of Kathmandu is a seismic gap, where there hasn't been a large earthquake since 1505. There have been some large quakes close by in Pakistan, where 100,000 people were killed in a magnitude 7.7 in 2001."

The team will head back to Wesnousky's research site in the foothills of the Himalaya as well as search in other areas for ground ruptures that may help scientists calibrate results from earlier studies and quantify the potential for additional earthquakes in the magnitude 8 or 9 range. From the Seismological Laboratory on the University's campus, Kent is coordinating the expedition to send Wesnousky and his two graduate students to Nepal to aid in the research.

"With a tragedy like this, it's tough to keep your science hat on, but we'll be concentrating on finding information that will help in the next months and years in quantifying what this fault could be capable of," Kent said. "We have some good guesses, but this is a rare enough event, with enough potential to actually get to see any ground ruptures, that we want to use the NSF research project to study it now. It's important work that will help us understand these gigantic fault zones and the earthquakes that propagate from them."

"With the devastation in the cities and villages, there may be little infrastructure, so where we might have ideally used helicopters to search for ground ruptures, we will be driving and hiking," Pierce, who studies with Wesnousky in the University's Center for Neotectonics Studies, said. "Helicopters have a more important mission of disaster response."

Pierce and Angster will bring, among other things, camping gear, solar panels, water filters and specialized photo equipment to record images of the walls of the trenches they will dig to examine layers of earth and any anomalies that indicate fault movement. They plan to be there for two weeks, possibly longer if they are successful in finding ground ruptures.

Provided by University of Nevada, Reno