Geologists find a new active fault in Nepal, potentially links climate with mountain building

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A Dartmouth researcher is part of a team that has discovered a new active "thrust fault" at the base of the Himalaya in Nepal. This new fault likely accommodates some of the subterranean pressure caused by the continuing collision of the Indian subcontinent with Asia.
The study, titled "Active out-of-sequence thrust faulting in the central Nepalese Himalaya," will be published in the April 21 issue of the journal *Nature*.

"This work tackles one of the fundamental questions in my field," says Arjun Heimsath, Assistant Professor of Earth Sciences and an author on the paper. "We are trying to determine whether climate is driving erosion, which may in turn impact tectonics, or whether tectonic forces drive erosion that subsequently influences climate. It's sometimes called the classic chicken-or-egg problem in geomorphology."

The researchers argue that this evidence quantifies a connection between erosion rates and tectonic forces, which might lead to a new understanding of how the growth of the Himalaya plays a role in global climate change. The new fault is found in an area where there is a dramatic change in the structure of the landscape, and it's in a region where the rainfall and erosion rates are among the highest in the world.

Heimsath explains that as India continues to collide with Asia, the Himalayan Mountain Range grows a centimeter or more each year, and

then the monsoons help bring about the erosion of the same mountains. The new active fault is at the base of the Great Himalaya in Central Nepal, about 60 miles from Kathmandu. Here, the landscape changes from low relief and gently sloping hills to steep, high mountains, and the researchers discovered that the erosion rates increase by a factor of four with the transition in topography.

"We used two different techniques of dating minerals in sediments to determine erosion rates spanning the last several thousand years as well as several million years," he says. "There was corroboration over drastically different time scales of erosion rates from several watersheds, suggesting a close connection between erosion and tectonics."

Heimsath and colleagues speculate that there may be some sort of feedback mechanism between erosion and tectonic movement, which might help reduce the potential energy accumulated by the uplift of the Himalaya and the formation of the Tibetan plateau, a vast region where the mean elevation is over 16,000 feet.

"The incredible mass of this uplifted plateau is struggling for someplace to go, and it's possible that focused erosion processes, which remove material at a high rate along the base of the Himalaya, are enabling a reduction in this accumulated potential energy. It's a continent-sized physics problem," he says.

Heimsath's coauthors on this study are Cameron Wobus, Kelin Whipple and Kip Hodges, all in the Department of Earth, Atmospheric and Planetary Sciences at Massachusetts Institute of Technology. Wobus, a current PhD student, is a former graduate student at Dartmouth.

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Source: Dartmouth College