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UCSB Scientists Study Ancient Debris Flows

The next "big one" in Santa Barbara may not be an earthquake but a boulder-carrying flood, according to Edward A. Keller, professor of geological sciences and environmental studies at the University of California, Santa Barbara, and his graduate student, Amy J. Selting.

Keller and Selting are studying

the origin and history of a large prehistoric debris flow they call the Mission debris flow, in Santa Barbara.

Selting presented a paper, co-authored by Keller, on the origin of the debris flow at the annual meeting of The Geological Society of America in Boston this month.

The scientists took a close look at two local parks Rocky Nook Park and Skofield Park that illustrate this dramatic part of the geological history of Santa Barbara.

"The city is built upon a landform known as an alluvial fan, a fan-shaped deposit consisting of stream gravels and debris flow deposits with an apex near the Santa Barbara Museum of Natural History," explained Keller.

A large part of the city, extending from downtown north to about Foothill Road, sits on top of deposits from debris flows, which most likely occur every few thousand years, according to Keller and Selting.

Such debris flow deposits are most dramatically expressed at Rocky Nook Park and on the grounds of the Santa Barbara Museum of Natural History, just north of the Santa Barbara Mission.

Rocky Nook is known for the beautiful, large boulders scattered throughout the park. "These boulders are composed of sandstone from the Santa Ynez Mountains," said Keller, "and we believe they record a catastrophic debris flow that occurred sometime in the recent geologic past," meaning within the past few thousand years.

The Rocky Nook boulders are positioned in an "open framework" configuration,

meaning they are piled on top of each other with gaps and open spaces between the boulders rather than fine sediment.

Such boulder accumulations are commonly observed resulting from modern debris flows (which are a mixture of water, mud, sand, gravel, and boulders).

The boulders are easily transported by the flow because the high density mixture of water, fine sediment, and boulders allows large boulders to "float" like corks on the top of the flow, explained Selting.

The finer particles that were initially between the boulders drain away with the water in the debris flow, leaving the pile of open framework boulders behind.

The cause of the prehistoric Mission debris flow is of considerable

interest to Selting and Keller.

The debris flow most likely originated in Rattlesnake Canyon, near Skofield Park, about a mile from the Rocky Nook Park deposits.

Based on their research, the scientists propose that a large landslide, with a volume around 10 million cubic yards, blocked Rattlesnake Creek at the present location of Skofield Park, forming a landslide dam in the canyon about 60 to 100 feet high.

"The presence of the landslide dam caused water to back up into Rattlesnake Canyon forming a temporary lake," said Selting, "and the failure of the dam most likely resulted when it was overtopped by the trapped water."

The water-saturated landslide deposits in the dam, including the large boulders of sandstone, were mobilized into the Mission debris flow, which surged down the

canyon, filling it with boulder debris to an estimated depth of 20 to 30 feet, say the researchers.

At the canyon mouth near Rocky Nook Park, the large debris flow spread out, destroying and burying everything in its path.

Debris flows can move at speeds ranging from 1 to 100 miles per hour.

"We do not know when this large debris flow occurred, but it probably was within the past few thousand years as the boulders are fresh, meaning they are not highly weathered, and the deposit surface appears to be geologically young," said Keller.

The cause of the large landslide is also unknown but, according to Selting, possible triggers include undercutting by Rattlesnake Creek, a period of excessive rainfall, or an earthquake.

Keller said that the flow that went through Rocky Nook Park and the museum property evidently stopped approximately near the intersection of State and Alamar streets in Santa Barbara, as that is the last place the boulders can be observed in abundance. "If such an event were to occur again today," said Keller "many homes and buildings, including the Museum of Natural History, would be destroyed and the loss of life would be catastrophic."

Added Selting:

"From a hazards standpoint, it is important to remember that everything we know about this debris flow seems to indicate that a large landslide was ultimately responsible for it.

In all likelihood, a landslide of this size occurring today in the south flank of the Santa Ynez Range would be noticed."

Were such a landslide to block a local canyon, there are several options for preventing it from becoming a further hazard, but early detection is of fundamental importance, according to Selting.

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