The strange rubbing boulders of the Atacama

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These are huge boulders in Chile's Atacama desert which appear to be rubbed very smooth about their midsections, leading University of Arizona geologist Jay Quade to wonder what could cause this in a place where water, Earth's most common agent of erosion, is as almost nonexistent. Credit: Image courtesy of Jay Quade.

A geologist's sharp eyes and upset stomach has led to the discovery, and almost too-close encounter, with an otherworldly geological process operating in a remote corner of northern Chile's Atacama Desert.

The sour stomach belonged to University of Arizona geologist Jay Quade. It forced him and his colleagues Peter Reiners and Kendra Murray to stop their truck at a lifeless expanse of boulders which they had passed before without noticing anything unusual.

"I had just crawled underneath the truck to get out of the sun," Quade said. The others had hiked off to look around, as geologists tend to do. That's when Quade noticed something very unusual about the half-ton to 8-ton boulders near the truck: they appeared to be rubbed very smooth about their midsections. What could cause this in a place where Earth's most common agent of erosion -- water -- is as almost nonexistent?

About the only thing that came to mind was earthquakes, said Quade. Over the approximately two million years that these rocks have been sitting on their sandy plain perhaps they were jostled by seismic waves. They caused them gradually grind against each other and smooth their sides. It made sense, but Quade never thought he'd be able to prove it.

Then, on another trip to the Atacama, Quade was standing on one of these boulders, pondering their histories when a 5.3 magnitude earthquake struck. The whole landscape started moving and the sound of the grinding of rocks was loud and clear.

"It was this tremendous sound, like the chattering of thousands of little hammers," Quade said. He'd probably have made a lot more observations about the minute-long event, except he was a bit preoccupied by the boulder he was standing on, which he had to ride like a surfboard."The one I was on rolled like a top and bounced off another boulder. I was afraid I would fall off and get crushed."

He managed to stay atop his boulder, of course, and became thoroughly convinced that the earlier hypothesis about the boulders was correct.

"I was just astonished when this earthquake came along and showed us how it worked," Quade said. Quade will explain the phenomenon on Tuesday, 11 Oct. at the annual meeting of the Geological Society of America in Minneapolis.

The whole story appears to be that the boulders tumbled down from the hills above -- probably dislodged by earthquakes. They accumulated on the sand flat, with no place else to go. Quade compares the situation to a train station where people are crowded together closely, rubbing shoulders as they waiting for a train. In this case the boulders have been stuck at the station for hundreds of millennia and the train never comes. So they just get more crowded and rub shoulders more over time.

Analyses of the boulder top surfaces suggest that they have been there one to two million years. That age, combined with the fact that seismic activity in the area generates a quake like that Quade witnessed on the average of once every four months, suggests that the average boulder has experienced 50,000 to 100,000 hours of bumping and grinding while waiting for that nonexistent train.

"It also answers a mystery that had been eating at me for years: How do the boulders get transported off the hills when there is so little rain," Quade said. "How do you erode a landscape that is rainless?"

Again the answer is seismic activity.

"It raises the question in my mind of other planets like Mars." If there is seismic activity, even from meteor impacts, might it also be creating similar landscapes? "I would predict that these kinds of crowds of boulders might be found on Mars as well, if people look for them."

More information: gsa.confex.com/gsa/2011AM/fina … /abstract_188948.htm

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