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# Subducting oceanic plates are thinning adjacent continents

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Credit: Tiago Fioreze / Wikipedia

The continental margins of plates on either side of the Atlantic Ocean are thinner than expected, and an international team led by a Rice University scientist is using an array of advanced tools to understand why.

According to Alan Levander, lead author of a new paper in *Nature* and the Carey Croneis Professor of Earth Science at Rice, the viscous bottom layers of the continental shelves beneath the Gibraltar arc and northeastern South America are literally being pulled off by adjacent subducting oceanic plates.

Removing the base of the continental margin can destabilize the plate further inland by creating topography on the base of the lithosphere, he said. The topography can trigger additional downwellings by setting up small-scale convection in the underlying asthenosphere. The space left by the sinking lithosphere is filled by rising asthenosphere. As it rises, the asthenosphere can undergo partial melting, which gives rise to surface volcanism.

Levander and his team saw evidence of "dripping" lithosphere in a previous study of the Colorado plateau, and he thinks these "secondary downwellings" are similar in nature and common. "We see similar downwelling under South America right now, and there's evidence that there's been downwelling under parts of North Africa," Levander said.

The researchers believe the new findings reconcile a number of "sometimes mutually exclusive" tectonic models at two subduction zones. "What I find interesting is that these two National Science Foundation (NSF) Continental Dynamics projects are on opposite sides of the Atlantic and they both involve relatively small subduction zones," he said. "But we see what we think are the same processes in each one."

None of this can be observed directly, but modern seismic instruments deployed in both regions have contributed greatly to Earth scientists' ability to view processes deep within the planet.

"Until recently, we didn't have a good way to tell where the bottoms of the tectonic plates were. Only with the development of fairly dense, observatory-quality seismic networks like USArray and dense deployments of instruments elsewhere in the world have we been able to determine local variations in lithosphere thickness," Levander said. Many seismology groups are now studying the lithosphere-asthenosphere boundary (the LAB) under the oceans and continents, he said.

The study used portable seismographs belonging to the NSF-funded IRIS/PASSCAL facility that were deployed for several years with instruments from Spain's IberArray and Venezuela's National Seismograph Network. From that data, geophysicists determined the topography of the LAB using techniques roughly similar to medical CAT scans and ultrasound images.

"People have had an idea where the base of the lithosphere is since the '70s and '80s, but only on a very large scale," Levander said. "Even regional variations were poorly resolved by the seismic data available at the time. There weren't enough instruments."

**More information:** *Nature*, www.nature.com/nature/journal/ … ull/nature13878.html

Provided by Rice University