Plate shapes may hold secrets to earthquakes

November 9 2011

The Andes from the air. Photo by Pattron on Flickr.

(PhysOrg.com) -- A new study from The Australian National University has brought scientists a step closer to finding out how earthquakes happen.

Dr Giampiero Iaffaldano from the ANU Research School of Earth Sciences and colleagues in Italy and Germany used simple but innovative laboratory models to examine the forces behind the movement of plates in the Earth's thick outer shell.

The team focused on the Nazca plate, which plunges beneath continental South America, because of its unusual curvature that is visible in the shape of the Andes. They found that a significant amount of force needed to be traded between the two plates to create the unique shape.

Dr Iaffaldano said this finding could help unravel the impact of plate interactions on large earthquakes.

“The lithospheric plates that make up the Earth’s outer shell move at a speed comparable to the growth of human nails,” he said. “But while their motions are well known from observations of the ocean floors, we still lack a detailed knowledge of the forces that plates trade with each other.

“These forces are responsible for deformation of the Earth’s crust, the rise of large mountain belts and ultimately the seismic behaviour of plate margins, so it is of paramount importance to understand their magnitude.

“Our study indicated that the curved shapes of plate margins are useful and precise diagnostics for the degree of coupling between lithospheric plates, which improves our understanding of the nature of tectonic movements.

“This could potentially help us resolve the dynamics of natural events along plate margins, such as earthquakes or volcanic eruptions.”

Dr Iaffaldano said the researchers mimicked plate motions in simple laboratory experiments.

“In our models, the Nazca and South America plates were simulated with layers of silicon putty plunging into big tanks of glucose syrup,” he said.

“We found that the peculiar shape of the margin only occurred if the two plates exchanged not less than 20 per cent of the force driving their motions.

“With more research in the future, we should gain a more detailed understanding of these forces by looking at how they varied in the past

million years, causing events such as mountain building."

Provided by Australian National University