Study reveals how continents can break apart

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A paper co-authored by CSIRO's Professor Klaus Regenauer-Lieb and published in *Nature* reveals new information on the strength of continents and how they can split apart.

Continents drift on the surface of the Earth in response to a recycling of oceanic plates, with new plates formed at rifts which are mostly located as sea-floor spreading centres in the middle of oceans. However, occasionally, the forces that cause the spreading of oceans can also break a continent apart to form a new ocean.

So it is important to understand how strong the continents are. Continental strength will not only influence how mountains develop or where and how continents break up, but also the distribution and size of seismic events.

The established view is that as we go deeper into the continent, rock strength increases to a depth of approximately 15km, and then decreases further down, as the rocks get hotter and flow as thick fluids. However, this expectation fails to explain, and even squarely contradicts, fundamental observations in geology.

The authors of the paper (titled The effect of energy feedbacks on continental strength), Klaus Regenauer-Lieb, Roberto F Weinberg and Gideon Rosenbaum, set out to investigate the dynamic feedback effects that take place when continents are submitted to strong forces. They developed numerical models where the strength of the continents result from basic physics and natural feedback processes, which had so far

been overlooked.

Surprisingly, it turns out that the 15km deep strongest part of the continents develops into a narrow weak zone which takes up most of the deformation. In other words, through dynamic interaction the strongest part becomes the weakest.

"These findings explain the origin of flat-lying zones of weakness known as detachment faults developed at depths of 10km to 15km which were not previously understood," Professor Regenauer Lieb says.

"Dynamic slip events were recorded in our model runs, which get very close to the slow movements pre- and post-dating earthquakes."

Such slow slip events have been described for the recent Sumatra Tsunami source mechanism.

The researchers have concluded that the continents are significantly weaker than previously suspected.

Source: CSIRO