Zealand Earthquakes Weakened Earth's Crust

Choi, LiveScience.com, 11-26-13

of deadly earthquakes that shook New Zealand in 2010 and 2011 may have weakened a portion
rust, researchers say.

aland lies along the dangeous Ring of Fire — a narrow zone around the Pacific Ocean where ab
of all the world's earthquakes, and 80 percent of the largest ones, strike

tatingmagnitude-6.3 quake struck New Zealand's South Island in 2011. Centered very close to
urch, the country's second-largest city, it killed 185 people and damaged or destroyed 100,000
s. The earthquake was the costliest disaster to ever strike New Zealand, consuming about one-si
try's gross domestic product

al earthquake was the aftershock of a magnitude-7.1 temblor that struck 172 days earlier (in 201
causing millions of dollars in damage to bridges and buildings, and seriously injuring two peop
h the 2010 temblor was stronger han its aftershock, it caused less damage because it occurred fa
m any city. The 2011 earthquake was, in turn, followed by a number of large aftershocks of its

s found that most of the earthquakes that struck New Zealand duringthese two years released
lly high levels of energy, consistent with those seen from ruptures of very strong faults in the E
learn more about this long series of energetic quakes, researchers analyzed the rocks beneath t
n as the Canterbury Plains

read weakening

mately 6 miles (10 kilometers) below the Canterbury Plains lies a large, extremely strong block
rock called the Hikurangi Plateau, which was pulled underground about 100 million years ago,
on of the Earth's surface it rested on dove under the edge of the ancient supercontinent Gondwa
attached toEarth's crust, welded to chunks of a dark, gray sandstone known as greywacke.

ntists analyzed seismic wavesdetected before and after the quakes by GeoNet, a network of
raphs across New Zealand. Based on this data, including seismic waves from more than 11,500
cks of the 2010 quake, they mapped the 3D structure of the rock under the Canterbury Plains, sin
ultrasound data can provide an image of a fetus in a womb

the surface broken by the quakes, the researchers identified a broad region that appeared to be
ally weaker after the quakes. This suggests there was widespead cracking of greywacke 3 miles

ere‘

in why weakeningwas seen in that particular region and not elsewhere after strong quakes, Rey
e increasing pressure and temperature seen with increasing depth in the crust that usually means
f more than about 6.8 miles (10.9 km), rocks are no onger brittle. As a result, the rocks often flo
hen force is applied to them

known as the brittle-plastic transition," Reyners said.

r, "because of the very strong rock unit underlying Canterbury, the brittle-plastic transition is ver
at about 35 kilometers [22 miles] depth," Reyners said. As such, widespread cracking and weak
ck occurred

archers will now focus on figuring out how widespread this strong block of rock is at shallow d
ut the eastern portion of the South Island of New Zealand. "This is important for defining the s
or communities in this region," Reyners said