

## Post-earthquake Seismic Reflection Survey, Christchurch, New Zealand



### **Dr. Don Lawton**

2013 CSEG Distinguished Lecturer

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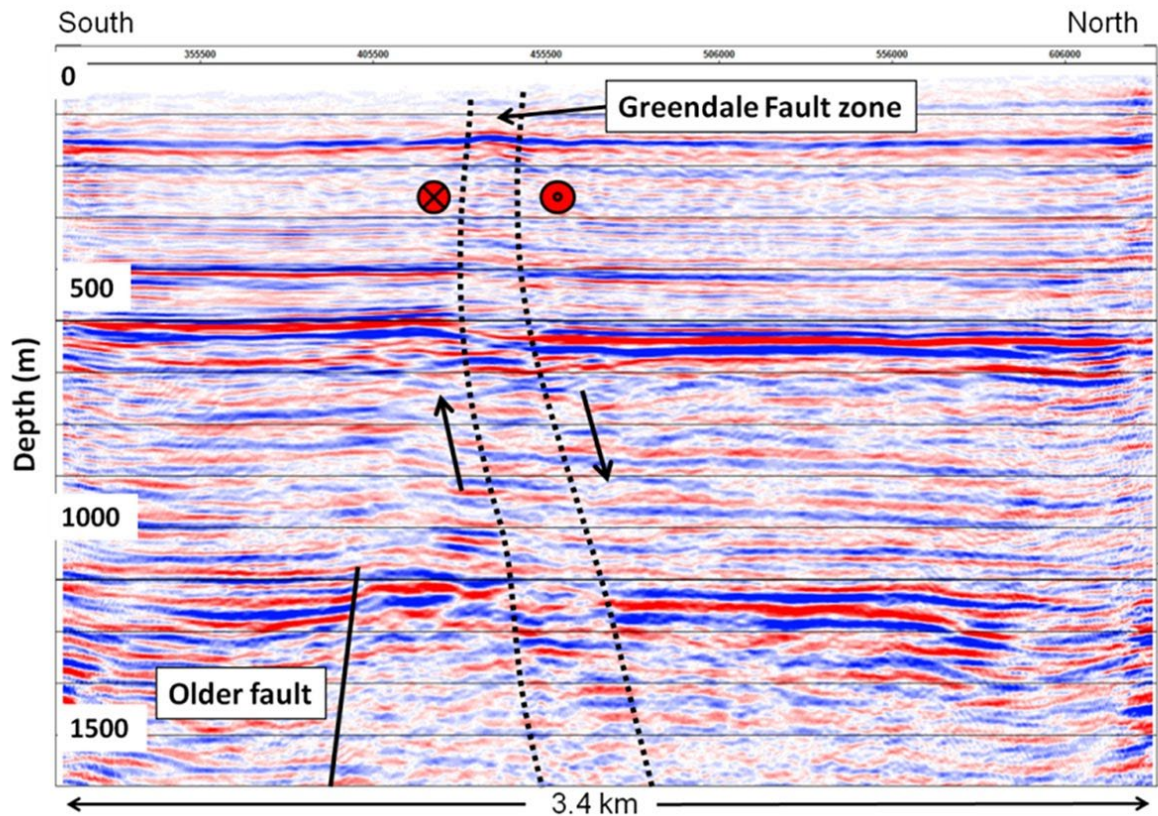
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## Abstract

On September 4, 2010, an earthquake struck the Christchurch region in New Zealand. The Mw 7.1 quake was centered about 40 km west of the city of Christchurch and caused significant damage but no loss of life. A key manifestation of the earthquake was a fault (Greendale Fault) that ruptured to the ground surface with a maximum dextral displacement of 5.1 m and a vertical displacement of 1.5 m, upthrown to the south. On February 22, 2011, a Mw 6.2 aftershock struck with a shallow hypocenter very close to Christchurch. This earthquake resulted in the loss of 182 lives and devastating damage (| \$23B) to the city infrastructure. Since September, 2010, the region has experienced over 10,500 aftershocks, with 42 of these being greater than 5M.

Approximately 45 line-km of high-fold reflection seismic data were recorded in and around Christchurch following the February 22, 2011 aftershock. The goal of the seismic program was to map previously unknown shallow faults in and around the city for hazard assessment and to assist in the post-earthquake recovery effort. Reflection seismic data were collected along six 2D lines, two of which were within the Christchurch metropolitan area and four were in rural areas west of the city. Recording conditions were challenging within the city, but good quality images were obtained along all of the seismic lines, with events interpretable to a depth of approximately 1.5 km. Numerous faults were imaged along the lines and these were interpreted in two groups – older faults that showed clear offsets in deep (> 1 km) reflections and younger faults that showed displacement in shallow reflections. Some faults in the latter group

were interpreted to be directly associated with hypocentres of the earthquake and aftershocks.



Interpreted seismic section across the Greendale Fault, Canterbury Plains, New Zealand.

## Biography

Don Lawton is a Professor of Geophysics and Chair in Exploration Geophysics in the Department of Geoscience at the University of Calgary. His research interests include acquisition, processing and interpretation of multicomponent seismic data, seismic anisotropy, integrated geophysical and geological studies in complex geological settings, and geological storage of CO<sub>2</sub>. He is an Associate Director of the Consortium for Research in Elastic Wave Exploration Seismology (CREWES) and is Theme Lead in Secure Carbon Storage for Carbon Management Canada, a Network of Centres of Excellence. In 2011 he led a team from the University of Calgary and CREWES to New Zealand for seismic imaging below the City of Christchurch following a devastating earthquake there. He is a past Editor of the Canadian Journal of Exploration Geophysics, and was a recipient of a Meritorious Service Award from the Canadian Society of Exploration Geophysicists (CSEG) in 1996 and the CSEG Medal in 2000. He is a member of SEG, AAPG, EAGE, CSEG, CSPG, ASEG, and APEGA.

## Distinguished Lecture Tour Itinerary (Tentative)

Date	Universities or Institutions Included	City
Oct. 10 11 am or 3 pm	Geological Survey of Canada GSC Atlantic Division	Dartmouth, NS
Oct. 12 afternoon	Memorial University Earth Sciences Govt of Newfoundland and Labrador, Dept. of Natural Resources, Geological Survey Division in attendance	St. John's, NL
Oct. 23 11:30 am	Dalhousie University Earth Sciences	Halifax, NS
Oct. 24 12:30 pm	Acadia University Earth and Environmental Sciences	Wolfville, NS
Oct. 25 12:30 pm	University of New Brunswick Earth Sciences	Fredericton, NB
Oct. 29 3:00 pm	Lakehead University Geology	Thunder Bay, ON
Oct. 31 3:30 pm	McMaster University Geography & Earth Sciences	Hamilton, ON
Nov. 2	University of Calgary Geoscience	Calgary, AB
Nov. 9 3:15 pm	McGill University Earth & Planetary Sciences	Montreal, QC
Nov. 19 9:30 am	Queen's University Geological Sciences and Geological Engineering	Kingston, ON
Nov. 20 11:30 am	Laurentian University Earth Sciences	Sudbury, ON
Nov. 21 4:00 pm	University of Toronto Physics (Geophysics); Geology	Toronto, ON
Nov. 22 11:30 am	University of Ottawa Earth Sciences Carleton University Earth Sciences	Ottawa, ON
Nov. 22 3:00 pm	Geological Survey of Canada Central and Northern Canada Branch Landslides and Geotechnics; Seismology and Electromagnetism; Geomapping for Energy	Ottawa, ON
Nov. 23 3:00 pm	Western University Earth Sciences	London, ON
Nov. 29	CREWES Sponsors Meeting	
Jan. 17	University of Manitoba	Winnipeg, MB
Jan. 18	University of Saskatchewan	Saskatoon, SK

Jan. 23 11:30 am	CSEG Technical Luncheon	Calgary, AB
Jan. 28 7:00 pm	Canmore Museum and Geoscience Centre Council Chambers	Canmore, AB
Jan. 31	University of Alberta	Edmonton, AB
Mar. 4	University of Houston	Houston, Texas
Mar. 6 4:00 pm	University of British Columbia	Vancouver, BC
Mar. 7 10:30 am	GSC Victoria	Sidney, BC
Mar. 13	CSPG International Group	Calgary, AB
Mar. 14 12:00 noon	Stanford University	Palo Alto, California
Mar. 19 1:30 pm	Simon Fraser University	Vancouver, BC
Mar. 20	University of Victoria	Victoria, BC