

The following application was submitted to the MARGINS Office:

Name:

Nicola Litchfield

Category: Post-doc Researcher

Address:

Institute of Geological and Nuclear Sciences
69 Gracefield Road
PO Box 30-368
Lower Hutt,
New Zealand

E-mail: n.litchfield@gns.cri.nz

Phone: +64 4 570 4891

Fax: +64 4 570 5679

Statement of interest:

My post-doctoral research examines the regional tectonics of the eastern North Island, on a 10000 year time scale, and thus constrains the underpinning tectonic processes affecting the Waipaoa Catchment. The research builds upon a similar study of river terraces along the Waipaoa River published by Berryman et al. (2000) (NZJGG 43: 229-245). I have also been involved in the recent study of post-glacial incision in the Waihuka River valley with Kelvin Berryman, Mike Marden, and Alan Palmer, for which a manuscript is currently in preparation. Once my post-doctoral research is completed in July 2004 I would like to continue working in the field of landscape evolution, and thus this workshop will give me the opportunity to explore future research opportunities and collaborations.

Short resume:

Current position and research:

I am a Foundation for Research, Science and Technology (FRST) post-doctoral fellow hosted at the Institute of Geological and Nuclear Sciences, Lower Hutt, New Zealand. My 3 year post-doctoral research is to use river terraces in the eastern North Island region to examine Hikurangi Subduction Margin tectonics on a 104 year time scale, and is mentored by Kelvin Berryman. The research builds upon, and extends regionally, research in the Waipaoa river catchment published by Berryman et al. (2000) (NZJGG 43: 229-245). The project is scheduled for completion in July 2004.

Scientific background:

I completed a Bachelor of Science and a Master of Science (with honours) in Geology at the University of Canterbury, New Zealand in 1992 and 1995 respectively. My MSc research examined the late Cenozoic structure and tectonic geomorphology of a series of active reverse faults in North Canterbury, part of the transfer zone from subduction at the Hikurangi Margin to continental transpression along the Alpine Fault, and was supervised by Jocelyn Campbell and Jarg Pettinga. Jan – May 1996 I was employed on contract at the National Institute of Water and Atmospheric Research (NIWA) as a GIS technician. My PhD thesis was completed in 2000 at the University of Otago, and was a multidisciplinary study of Quaternary tectonics in coastal Otago, south of Dunedin, at the leading edge of the Otago reverse fault province. The research was supervised by Richard Norris, Chuck Landis and Peter Koons. Sept-Nov 2000 I held a co-ordinating role in the multidisciplinary University of Otago research grant funded study of groundwater in the Taieri Plains. Late 2000 and early 2001 I was employed on contract at IGNS as a Paleoseismology Research Assistant, which included helping organise the International Lithosphere Program “Ten Years in Paleoseismology” conference in Kaikoura, Dec 2001.

Research Interests:

The relationship between landscape evolution and tectonic and climatic processes
Paleoseismology and earthquake geology
Quaternary climate change
Tectonically controlled sedimentary processes

Professional Activities:

Geological Society of New Zealand Member
New Zealand Geophysical Society Member
Royal Society of New Zealand Member
American Geophysical Society Member

Key Publications:

Berryman, K.; Marden, M.; Palmer, A.; Wilson, K.; Mazengarb, C.; Litchfield, N. In Preparation. Observations of river downcutting in the Waihuka River, Gisborne, New Zealand, and implications for tectonics and landscape evolution.

Litchfield, N.J.; Campbell, J.K.; Nicol, A. In Press. Recognition of active reverse faults and folds in North Canterbury, New Zealand, using structural mapping and geomorphic analysis. *New Zealand Journal of Geology and Geophysics*.

Litchfield, N.; Van Dissen, R.; Langridge, R.; Heron, D.; Prentice, C. Timing of the most recent surface rupture event on the Ohariu Fault near Paraparumu, New Zealand. Submitted to *New Zealand Journal of Geology and Geophysics*.

Litchfield, N.J.; Lian, O.B. Luminescence ages of Pleistocene marine terrace and alluvial fan sediments associated with tectonic activity along coastal Otago, New Zealand. Submitted to *New Zealand Journal of Geology and Geophysics*.

Litchfield, N.; Craw, D.; Koons, P.; Edge, B.; Murray, D.; Parraudin, E.; Peake, B. 2002. Geology and geochemistry of groundwater flow within the Taieri Basin,

east Otago, New Zealand *New Zealand Journal of Geology and Geophysics* 45(4): 481-497.

Litchfield, N.J. 2002. Using River Terraces to examine Hikurangi Subduction Margin Dynamics. *Western Pacific Geophysics Meeting, 9-12 July 2002, Wellington, New Zealand. EOS, Transactions, American Geophysical Union* 83(22): WP113.

Litchfield, N.J. 2001. The Titri Fault System: Quaternary active faults at the leading edge of the Otago reverse fault province. *New Zealand Journal of Geology and Geophysics* 44(4): 517-534.

Litchfield, N.J.; Norris, R.J. 2000. Holocene motion on the Akatore Fault, south Otago coast, New Zealand. *New Zealand Journal of Geology and Geophysics* 43(3):405-418.

Rees Jones, J.; Rink, W.J.; Norris R.J.; Litchfield, N.J. 2000. Optical luminescence dating of uplifted marine terraces along the Akatore Fault, near Dunedin, South Island, New Zealand. *New Zealand Journal of Geology and Geophysics* 43(3):419-424.

Litchfield, N.J. 2000. Quaternary deformation at the leading edge of the Otago Reverse Fault Province. PhD Thesis, University of Otago.

Litchfield, N.J. 1999. Late Quaternary sea-levels and shore platforms on a tectonically rising coastline, New Zealand. The non-steady state of the inner shelf and shoreline: coastal change on the time scale of decades to millenia in the late Quaternary. *International Geological Correlation programme, project 437 conference, Nov. 9-12, 1999, Honolulu, Hawaii.*

CANZ, 1996. "Undersea New Zealand" (New Zealand Region physiography). 1:4 000 000 (2nd ed). *New Zealand Oceanographic Institute Chart, Miscellaneous Series no. 74.*

Litchfield, N.J. 1995. The effects of oblique compression on folding, examples from north Canterbury, New Zealand. *Geological Society of America Penrose Conference on fault-propagation folding. Banff, Alberta, Canada, 22-27 August, 1995.*

Litchfield, N.J. 1995. Structure and tectonic geomorphology of the Lowry Peaks Range & Waikari Valley district, North Canterbury. MSc(hons) thesis, University of Canterbury.

Hikurangi Margin tectonics recorded by incision of the Ohakean river terrace in the eastern North Island

- - - - - * - - - - -

ABSTRACT

Title:

Hikurangi Margin tectonics recorded by incision of the Ohakean river terrace in the eastern North Island

Authors:

Nicola Litchfield, Kelvin Berryman
Institute of Geological and Nuclear Sciences, Lower Hutt, New Zealand

Abstract:

The Ohakean river terrace, an aggradation river terrace formed during the Last Glacial Maximum, is preserved along all the major rivers of the eastern North Island, New Zealand. Aggradation occurred in response to increased sediment supply during the last glacial period, when the treeline was lowered and periglacial processes were operating in the non-glaciated catchments. Synchronous with greywacke cobble-boulder gravel and minor sand aggradation in the river beds, loess was deposited on the surrounding slopes. The c. 26.5 ka (calibrated age) Kawakawa Tephra is sporadically present within both the aggradation terrace deposits and the equivalent age loess, and in the north, c. 18 ka (cal. age) Rerewhakaitu Tephra rests on the terrace surface.

This study aims to compare incision rates of the Ohakean river terrace along each of the major rivers that drain the backstop (Axial Ranges) and uplifted forearc basin of the Hikurangi Margin. The Hikurangi Subduction Zone is inferred from geophysical studies to be variably locked beneath the eastern North Island, and it is hoped that the pattern of incision rates will highlight changes in uplift rate along the Margin that may be associated with inferred changes in locking.

New terrace mapping is presented here for six catchments, with compiled pre-existing data from a further four. The terrace mapping shows variation in size and preservation between catchments, with the broadest terraces occurring within the low-topography western side of the uplifted forearc basin. Longitudinal profiles have been constructed for the trunk rivers using published topographic map data, Regional Council river bed survey data, and high resolution RTK GPS measurements. The profiles likewise show variation between rivers; in some the Ohakean terrace surface is parallel to the present river profile, in others it diverges upstream.

Provisional incision rates have been calculated using an age of terrace abandonment of 18 ± 2 ka, which may be refined in the future with further terrace dating, particularly using OSL. Incision rate measurements are plotted in map view and colour-coded, in order to highlight regional patterns. Rates are generally low in the south, ie. from Wairarapa to southern Hawkes Bay, but increase rapidly in northern Hawkes Bay. Moderate incision rates also occur along the Rangitikei River, on the western side of the axial ranges, ie. further away from the plate boundary.

Future work will add data from other rivers, refine the age of the terrace abandonment, and use numerical modelling to interpret the incision rate data in

terms of plate boundary uplift. Questions that need to be addressed include:
What are the relative influences of other factors driving terrace incision, such as variation in rainfall and lithology?, and, How do the incision rates compare to uplift rates on different time scales, eg. geodetic measurements, marine terrace uplift, and geological uplift rates?

Wish to include graphics:

Server protocol: HTTP/1.1
Remote host: grfw2177.gns.cri.nz
Remote IP address: 131.203.6.221