The following application was submitted to the MARGINS Office:

Name:
Alan Orpin

Category: Post-doc Researcher

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Statement of interest:
This workshop will provide an opportunity to present new data from the Poverty Bay shelf basin and adjacent margin re-entrant derived from multibeam bathymetry, seismic, backscatter, and stratigraphic techniques, and outline a revised post-glacial sediment budget for the Waipaoa sedimentary system. Of note is the sedimentology and rates of sedimentation on the continental slope, the seaward extension of the Waipaoa depositional system. Some of these data stem directly from existing collaborative work with other MARGINS workers, and links fostered by this workshop might target areas of research and techniques to further our understanding of sedimentation along the East Coast margin. Of particular relevance is the effect of large floods on sediment fluxes to the upper slope.

Short resume:
Alan R. Orpin

Education:

Ph.D 1999 James Cook University, School Earth Sciences
M.Sc. (Hons.) 1992 University of Otago, Department of Geology
B.Sc. 1990 University of Otago, Department of Geology

Employment:

2000-2003 NZST FRST Postdoctoral Fellow, NIWA Wellington
1999-2000 Contract marine sedimentologist, Marine Geophysical Laboratory, James Cook University.
1998 Environmental Scientist, Fleur Daniel GTI, Townsville
1993 High School teacher, commercial fisherman

Research:

My current postdoctoral research programme is primarily focused on the Waipaoa land-ocean sedimentary system that encompasses the continental shelf and slope seawards of the Waipaoa River in Poverty Bay. The study aims to determine the climatic, oceanic and human controls on post-glacial sedimentation in the marine environment with particular focus on fluxes to the continental slope.

My Ph.D. research in tropical northern Australia examined the modern sedimentology of inner shelf sediments from the Great Barrier Reef lagoon, with the aim of determining the potential distribution and significance of the modern riverine sediment input. It primarily focused on the manipulation and interpretation of high-resolution particle size data, sediment stratigraphy, sediment facies mapping, sediment hydrodynamics, and geochemistry. I examined sediment pathways, sources and sinks, and developed and published new methods to obtain sediment budgets.

Recent publications

Orpin, A.R. (submitted). Postglacial sediment flux into the Poverty margin re-entrant by the very high sediment yield Waipaoa River, northeastern New Zealand. Marine Geology.

Orpin, A., Carter, L., Lewis, K., Kuehl, S, and Alexander, C. (2002). Quantifying deposition from the very muddy Waipaoa River on the Poverty shelf and margin re-entrant, East Coast New Zealand. Abstract and Programme, GSNZ Annual Conference "Northland 2002", Geological Society of New Zealand Miscellaneous Publication 112A, pp.43.

Orpin, A.R., Carter. L., Kuehl, S.A., Trustrum, N.A, Lewis, K.B., Alexander, C.R., and Gomez, B. (2002). Deposition from very high sediment yield New Zealand rivers is captured in upper margin basins. MARGINS Newsletter no. 9, pp.1-4.

Orpin, A.R., Carter. L., Lewis, K.B., Alexander, C.R., and Kuehl, S.A. (2002). Sediment capture on an incised active margin, Poverty Re-entrant, East Coast, New Zealand. (oral presentation). Western Pacific Geophysical Meeting Supplementary Abstract U41A-05. Eos Transactions AGU 83 (22), 127.

Lewis, K.B. and Orpin, A.R. (2002). Multibeam Images of submarine landscape evolution on an active convergent margin, Poverty Re-entrant, New Zealand (poster). Western Pacific Geophysical Meeting Supplementary Abstract U41A-05. Eos Transactions AGU 83 (22), 78.

Neil, D.T., Orpin, A.R., Ridd, P.V. and Yu, B. (2002). Sediment yield and impacts from river catchments to the Great Barrier Reef lagoon. Marine and Freshwater Research 53, 733-752.

Orpin, A.R., Ridd, P.V. and Stewart, L.K. (1999). Assessment of the relative importance of major sediment transport mechanisms in the central Great Barrier Reef lagoon. Australian Journal of Earth Sciences 46, 883-896.

Orpin, A.R. and Woolfe, K.J. (1999).Unmixing relationships as a method of deriving a semi-quantitative terrigenous sediment budget, central Great Barrier Reef lagoon, Australia. Sedimentary Geology 129, 25-35.

Recent Collaborators: Steve Kuehl (VIMS); Clark Alexander (Skidaway); Noel Trustrum (Landcare); Peter Ridd (JCU); Gregg Brunskill (AIMS).

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ABSTRACT

Title:

Quantifying deposition from the very muddy Waipaoa River on the Poverty shelf and margin re-entrant, East Coast New Zealand

Authors:

Alan Orpin (1), Lionel Carter (1), Keith Lewis (1), Steve Kuehl (2), Barbara Manighetti (1), and Clark Alexander (3)

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2. Virginia Institute of Marine Science, Gloucester Point, VA, USA
3. Skidaway Institute of Oceanography, Savannah, GA, USA

Abstract:

The East Coast margin is characterised by high terrigenous sediment flux, dramatic effects of land-use changes, and by complex sediment-tectonic interactions on a steep and unstable continental slope. An estimated 18 cubic km of sediment has been deposited in an actively subsiding mid-shelf basin and outer shelf apron since 18 ka BP, with a maximum thickness of approximately 45 m. The shelf is boarded along its seaward edge by two growing anticlines, but a significant component of the sediment leaks through a 13 km-wide gap between the anticlines and cascades into a large structural re-entrant that is heavily incised by the Poverty submarine canyon system. 210Pb mass accumulation profiles indicate that the modern post-settlement sedimentation rate of around 0.9 cm/yr on the outer shelf is double that recorded at the mid-shelf. Hence, the modern

sediment accumulation is inconsistent with the post-glacial sediment thicknesses, which show the largest volume has accumulated on ! the mid-shelf. This may suggest an increasing frequency of Waipaoa-derived hyperpycnal flows with the ability to transport sediment seawards, or a change in the storage pattern within Poverty Bay. Accumulation rates on the slope are an order of magnitude less, around 0.1 cm/yr.

Cores and multibeam images suggest that Poverty Canyon is inactive as a modern sediment pathway. The mouth and floor of the canyon are composed of stiff Pleistocene mud, overlain by a thin drape of unconsolidated mud. The seabed at the canyon mouth is highly reflective, deeply scoured, and lacks a fan. These features indicate little or no sediment flux. During lowstand, the ancient Waipaoa River is likely to have been in the gap between the anticlines, and turbidites in one upper slope canyon suggest it could have tapped into the lowstand riverine sediment supply. Most of the lowstand sediment was apparently captured on the shelf and in the mid-slope re-entrant. Aggradation on the subsiding coastal plain (now the mid-shelf basin) may also have occurred. Accepting near-full capture of riverine-derived sediment on the shelf and slope, accumulation rates indicate that the modern (post-settlement) sediment yield from the Waipaoa River is almost an order of magnitude higher than ! the average for the Holocene. This is broadly compatible with accelerated rates of landscape erosion measured onshore.

Studies on margins fed by high yield rivers have demonstrated that some hyperpycnal gravity-driven flows can transport significant quantities of mud tens of kilometres across the shelf, perhaps bypassing the shelf, and supplying sediment to the slope directly. This sedimentation pattern supports the notion that a major fraction of terrigenous sediment supplied to the ocean by flood-prone mountainous rivers bypasses shelves of tectonically active continental margins. A revised sediment budget suggests that, despite the Waipaoa’s very high sediment yield, the majority of its load is effectively captured in basins on the shelf and margin re-entrant.

Wish to include graphics:

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