

Post-orogenic landscape evolution in a high-elevation passive margin highland belt, SE Australia: bedrock river channel processes and cosmogenic nuclide analysis

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Topographic steady-state, tectonically active areas have received by far-and-away the bulk of recent research attention on bedrock rivers, yet post-orogenic terrains constitute the major part of the Earth's surface. Our understanding of the fundamental controls on the development of post-orogenic landscapes lags far behind that of tectonically active areas and this project will assess the fundamental geomorphological issue of the role of resistant lithology in landscape evolution in the classic post-orogenic setting of a high elevation passive continental margin. The project will focus on bedrock river characteristics and processes in knickpoints in resistant lithologies where knickpoints appear to be the dominant transmission process of the signal of base-level fall. It will build on an extensive terrestrial cosmogenic nuclide (TCN) data set on rates of channel incision and catchment lowering from the work of Marie Curie Research Fellow Dr Esperanza Muñoz-Salinas, who will be associated with the project for its first year. The characterisation of bedrock river processes and landscape evolution rates will enable testing of long-standing competing hypotheses for pathways of post-orogenic landscape evolution.

The project will be set in the Lachlan valley, NSW, which drains the inland sector of the high elevation passive continental margin of SE Australia. The history of this margin is now well-known from two decades of research by Bishop and his PhD students (e.g., Goldrick & Bishop. 2007. *Earth Surface Processes and Landforms* 32: 649-671 (doi: 10.1002/esp.1413); Persano *et al.* 2005. *Journal of Geophysical Research* 110: B12405 (doi: 10.1029/2004JB003325)). It provides an ideal setting to test hypotheses concerning post-orogenic landscape evolution (see recent review of this and other matters by Bishop (2007. *Earth Surface Processes and Landforms* 32, 329-365 (10.1002/esp.1493)).

The student will:

1. characterise bedrock channel morphologies and processes (e.g., width, depth, gradient, sediment character and cover, dominant processes) in order to understand the processes of bedrock channel lowering and knickpoint retreat in a post-orogenic setting;
2. derive, test and apply measures of lithological hardness to be integrated with the morphological and process data from 1.;
3. relate these data to the existing TCN data (from the Marie Curie project) and generate supplementary TCN data to test specific aspects of the process interpretation; and
4. integrate those data in a numerical model of long profile evolution and catchment response to base-level fall.

The student will join the sub-group of GES-SUERC's *Earth System Research Group* working on TCN analysis and morphological/process in bedrock rivers. The student will be trained in all aspects of cosmogenic nuclide analysis, from field collection of samples to mineral separation to nuclide analysis at SUERC (for stable nuclides) and target preparation (for radio-nuclides; at the joint GES-SUERC target preparation lab at SUERC). In the latter case, the student will also be able to observe and participate in the radionuclide measurements at our accelerator mass spectrometer at SUERC. The student will be fully trained in field mapping of bedrock channels and the characterisation and analysis of bedrock river process, as informed by the cosmogenic nuclide analysis, and in numerical modelling of landscape evolution. S/he will join a very active group in Glasgow employing cosmogenic nuclide analysis (including the Supervisors, plus two research fellows (Dr John Jansen [NERC Fellow] and Dr Esperanza Muñoz-Salinas [Marie Curie Fellow] and four PhD students) as well as a group working on bedrock river processes (Professor Trevor Hoey, Research Fellow Dr Rebecca Hodge and Edinburgh colleague Dr Mikaël Attal [Edinburgh], who will co-supervise this project [<http://www.geos.ed.ac.uk/homes/mattal/>]). Co-supervision by Dr Attal means that the student will be affiliated with the Graduate School of SAGES (www.sages.ac.uk) and attendant benefits. For details contact paul.bishop@ges.gla.ac.uk

Application procedure and deadlines

To be considered for PhD studentships to be held in the School of Geographical and Earth Sciences (GES), suitably qualified candidates should apply via the website of the College of Science and Engineering (<http://www.gla.ac.uk/colleges/scienceengineering/graduateschool/prospectivestudents/essentialinformation/>). Closing dates for University and research council funded studentships will be in early in the new year, as stated on the GES studentships page: (<http://web2.ges.gla.ac.uk/~mlee/GES%202010%20studentships>).

Non- English speakers must meet the University's English language requirements. Candidates for NERC studentships should also meet the NERC's requirements for both academic qualifications and residential eligibility. For more information go to <http://www.nerc.ac.uk/funding/application/studentships> and please note that *non-UK European Union citizens will be awarded fees only by NERC.*

For informal enquiries about the research projects please contact the relevant supervisors. Information on the GES graduate school and the application process can be obtained from Mrs Jean McPartland, the assistant to head of the School (Jean.McPartland@glasgow.ac.uk), or Professor Susan Waldron (Susan.Waldron@Glasgow.ac.uk), the head of the GES graduate school.