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15th February 2015

Re: Report on 'Scaling bedrock erosional processes across space and time: from pothole dynamics to gorge development.'

Dear Professor Bateman,

I write in order to give an account of my work related to the ECR project 'Scaling bedrock erosional processes across space and time: from pothole dynamics to gorge development' awarded £4950 by the British Society for Geomorphology.

As specified in the application, these monies were used to fund 10 days of field work by myself and a field assistant at Ritchie Falls near Onseepkans on the Orange River, South Africa. Measurements of pothole width, depth, depth of fill and grain size of fill were made on 120 potholes ranging in size from ~ 0.2m to 3m in diameter. These measurement were spread over four separate sites: 1) a site located ~ 6 km upstream of the Ritchie Falls where potholes densities are less than at other sites and where pothole dimensions were smaller (< 1 m); 2) 2.2 km upstream of the Ritchie Falls, where densities and dimensions are greater (1-3 m); 3) at the knickzone itself (~ 1.6 km upstream of the Ritchie Falls), where the largest and most densely spaced potholes are located and where they have merged and formed channels through the bedrock; and 4) at the Ritchie Falls themselves, where pothole densities and dimensions are less. An assessment of the characteristics of the bedrock at each site was made using the Selby Score system and pothole density was also measured.

Samples of the granite bedrock surrounding well-developed potholes were taken and shipped back to the UK for cosmogenic dating in order that rates of bedrock erosion, and thus minimum rates of pothole development, can be obtained. As specified in the application, a further application will be made to the NERC Cosmogenic Isotope Facility for analysis of these samples. If this application is unsuccessful, the samples will possibly be analysed by colleagues in a newly-established laboratory in South Africa (iThemba LABS). Funding also enabled us to visit Augrabies Falls National Park where we observed the way in which spectacular landforms and geomorphological processes were communicated to the public through interpretive information boards and written material in leaflets and guidebooks.

Analysis of pothole size data is ongoing, but the final outputs of the project will include:

1) a presentation to the 2015 BSG Annual Meeting in Southampton (provisional title: Scaling bedrock erosional processes across time and space);
2) a paper submitted to *Earth Surface Processes and Landforms* (ESP&L) in 2015 (provisional title: as above).
3) a paper submitted to the *South African Geographical Journal* describing and explaining the development of Ritchie Falls (previously neglected despite its position as the second largest waterfall on the Orange River).
4) if cosmogenic isotope analyses are informative a paper will be submitted to *Geology* focusing on the nature and development of bedrock anabranching, as displayed at Ritchie Falls.

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5) interpretive material on potholes and bedrock rivers for public distribution through local national parks in Wales, and potentially the BSG website. This material will be combined with outputs from other funding (see (2) below).

Support provided by the BSG was used to leverage additional funding from two sources, both of which will allow me to build on the opportunities created by the BSG ECR award.

1) £1700 was provided by the *Coleg Cymraeg Cenedlaethol* (Welsh National College) to extend the work on Welsh bedrock rivers (specifically the measurement of potholes on bedrock reaches of Welsh rivers). This funding was specifically used to create opportunities for undergraduate students to participate in data collection over the summer of 2014 and to use the data as a basis for creating educational resources focused on data handling, manipulation and analysis for physical geography undergraduates. While the project is ongoing, data have been collected on the Afon Ystwyth, Afon Efyrnwy and Afon Teifi and will complement data collected on the Orange River for the presentation to the 2015 BSG Annual Meeting and to the paper to *ESP&L*.

2) the understanding of geoheritage promotion gained by preparation for the Orange River fieldwork contributed to the preparation of a successful application to the Joy Welch foundation (£3000) entitled ‘Can we harness geomorphological knowledge of extreme events to promote sustainable tourism?’

In terms of communicating geomorphology to the general public, I contributed to the BBC *Radio Cymru* nature programme *Galwad Cynnar*, describing the nature of the project and fieldwork. In a general sense, the ECR award has also allowed me to develop ideas regarding communicating geomorphology, which will hopefully be realised this year in a Welsh translation of Tooth and Viles’s ’10 reasons why geomorphology is important,’ published by the BSG.

Please also find attached an account of expenditure. Copies of receipts have been sent in hard copy to the BSG office. I trust that this report is a satisfactory account of my expenditure on this grant. If not, please do not hesitate to contact me. Thank you once again for the generous award, which has allowed me to carry out this work and which has provided a particularly strong foundation for future work.

Yours sincerely,

Dr. Hywel Griffiths,

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Table 1: Nature and amount of expenditure

Expenditure	**Amount**
International and internal flights (two people)	£2728.02
Car rental in South Africa	£350.61
Shipping Cosmogenic Samples to the UK	£644.46
Field costs (travel to airport in UK, SA accommodation[1], subsistence, diesel, field equipment, entrance fees to Augrabies Falls National Park)	£1035.78
Total	£4758.87

[1]Despite considerable chasing we have still not been sent an invoice for the majority of the accommodation bill (~ £150 for camping at Onseepkans). We will continue to chase them for an invoice and will pay the bill once we receive it.