

## The interplay of terrestrial volcanism and shoreface sedimentation

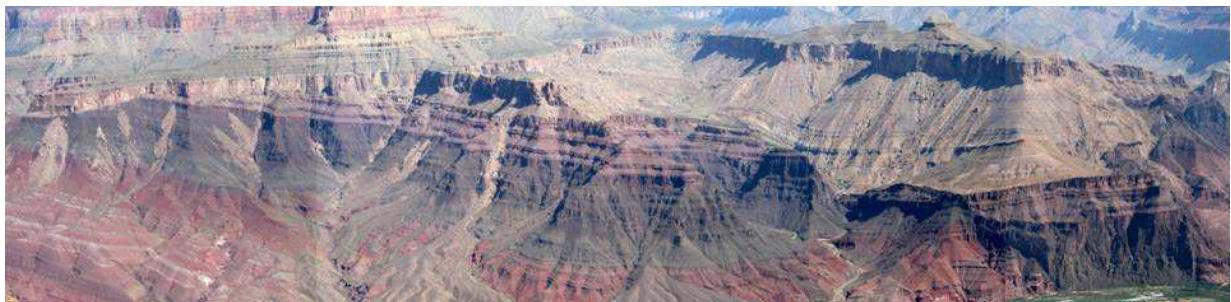
**Brian Bell and David Brown**

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This field-based project will look at the stratigraphic architecture of the shoreface clastic units of the Dox Formation and the terrestrial lavas of the Cardenas Formation within the Proterozoic Grand Canyon Supergroup in the Grand Canyon, Arizona, USA. The focus of the project is to determine how these two competing depositional systems developed and controlled their respective lithofacies.

Funding is through the oil industry -sponsored 'Volcanic Margins Consortium' and it is envisaged that the project will start in September 2011.

Recent oil and gas discoveries in intra-volcanic sandstones in the offshore Faroe-Shetland Basin (FSB) have highlighted the need for detailed understanding of competing volcanic and sedimentary depositional systems. Current understanding of the architecture of these interbedded fluvial, deltaic and shallow marine siliciclastic and volcanoclastic sedimentary units and (predominantly) terrestrial basaltic lavas, is that there were competing inputs of basin margin volcanism and sediment within a system undergoing base level change. The shoreface clastic units of the Dox Formation and the terrestrial lavas of the Cardenas Formation in the Grand Canyon Supergroup provide a rare, near-perfect analogue for the appropriate FSB offshore sequences, and will be used to understand the stacking pattern, interplay and overall architecture of the volcanic and sedimentary systems. Of particular interest is the potential “contamination” of reservoir lithologies by volcanic material.



**Bedded sandstones of the Dox Formation (red) overlain by the Cardenas Lavas (grey) and the sedimentary Nankoweap Formation. Note the angular unconformity with the overlying Tapeats Sandstone.**

The rocks of the Dox Formation record a transgression from a deltaic to wholly marine environment. The overlying Cardenas Lavas are interbedded with the uppermost part of the Dox Formation and are themselves interbedded with siliciclastic and volcanoclastic sandstones and a variety of pyroclastic units. Changes in base level are recorded by lithofacies variations in the lavas and clastic units and indicate a dynamic shoreface environment.

This project will investigate the geological development of the Dox Formation and the Cardenas Lavas. Detailed field mapping and logging will be undertaken in order to examine and document the physical volcanology, sedimentology and 3-D stratigraphic architecture of these units. These data will be used to develop facies models of the depositional system and determine reservoir/seal characteristics at the outcrop scale. Petrographic and chemical analyses using optical and scanning electron microscopy will be undertaken to further describe and interpret key lithologies, and determine their micro-scale reservoir/seal characteristics (e.g. poroperm, diagenesis, mineralogy). These macro and micro-scale observations will be integrated and used to refine depositional models of offshore analogues. It is envisaged that two main field seasons will be involved, most likely in the autumn of 2011 and 2012. All necessary analytical facilities are available.

The student will receive training in:

- 1) mapping and logging of lavas, volcanoclastic (pyroclastic, autoclastic and reworked materials) and siliciclastic sedimentary rocks, using a rigorous lithofacies approach
- 2) development of facies models and reservoir characterisation
- 3) optical microscopy and the SEM

This project is part of the Volcanic Margins Consortium, a collaboration of industry sponsors and academic partners at Glasgow, Durham University and the University of Aberdeen. The student will benefit from regular meetings, workshops and field classes (both UK and abroad) with consortium members, including other PhD students. Close links will be maintained with the industry sponsor, including a 3 month sabbatical with the company.

### **Further Reading**

Lucchitta, I. and Hendricks, J. D. (1983). Characteristics, depositional environment, and tectonic interpretations of the Proterozoic Cardenas Lavas, eastern Grand Canyon, Arizona. *Geology*, v.11, 177-181.

### **Application procedure and deadlines**

The candidate should have a 1<sup>st</sup> class or good 2:1 degree in Earth Science/Geology and a strong interest in physical volcanology/sedimentology and fieldwork.

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:

[\(http://www.gla.ac.uk/colleges/scienceengineering/graduateschool/prospectivestudents/essentialinformation/\)](http://www.gla.ac.uk/colleges/scienceengineering/graduateschool/prospectivestudents/essentialinformation/).

Non-English speakers must meet the University's English language requirements.

For informal enquiries about the research project please contact the supervisors. Information on the GES graduate school and the application process can be obtained from Jean McPartland ([Jean.McPartland@glasgow.ac.uk](mailto:Jean.McPartland@glasgow.ac.uk)), assistant to the Head of School, or Professor Susan Waldron ([Susan.Waldron@glasgow.ac.uk](mailto:Susan.Waldron@glasgow.ac.uk)), the Head of the GES graduate school.