**Sediment structure, hydrology and erosion in restored saltmarshes**

Coastal saltmarshes are a globally important habitat, but are under threat from population growth, coastal erosion and sea level rise. To compensate for this habitat loss and loss of associated ecosystem services, saltmarshes are frequently restored whereby hard coastal defences are removed to allow the inundation of previously defended areas (e.g. managed realignment).

These newly-created wetlands have the potential to deliver ecosystem services including biodiversity, coastal defence, climate regulation and detoxification (Spencer and Harvey 2012). However, there is increasing evidence to suggest that restored saltmarshes may not offer the same ecosystem services as their natural counterparts, with different hydrological and biogeochemical characteristics compared to undisturbed wetlands (Tempest et al. 2014; Morris et al. 2014).

The aim of this PhD is to explore the impact of pre-restoration land-use on the sediment sub-surface environment and its impact on ecosystem services particularly saltmarshes as a coastal defence and flood storage. Potential methods could include novel 3-dimensional micro-computed tomography to quantify sediment, root and porosity networks in the sediment.

Please contact Kate Spencer (k.spencer@qmul.ac.uk) for further information about this project.

**Past intermediate and deep ocean circulation during sustained periods of warmth**

The ocean is absorbing much of the heat and carbon dioxide emissions related to human caused climate change, but the long-term impacts on heat transport, carbon cycling and deep ocean circulation are poorly understood. Looking at past warm periods such as the Last Interglacial (125,000 years ago) and other "Super-Interglacials" where global temperatures are estimated to be 0.5 to 1.5°C warmer than today may provide insight into how the ocean accommodates heat and carbon. This project will use a suite of locations in the Atlantic and/or Pacific to characterize and map intermediate and deep water masses and ocean circulation.

This project necessitates a multi-proxy approach including stable isotopes (d13C, d18O), minor (Mg/Ca, temperature) and trace elements (B/Ca, [CO32-]) and trace isotopes (ENd). The project can be tailored to focus on regional (e.g. North Atlantic, Southern Ocean) or basin-wide reconstructions of ocean circulation depending on the research interests of the student.

Please contact Heather Ford (h.ford@qmul.ac.uk) for further information about this project.

**Identifying topographic signatures of ancient and modern Martian surface processes**

Since the 1970s scientists have been captivated by the complex topographic features observed on the surface of Mars, including apparent fluvial channels, lake deltas and mass movements. Recent discoveries have demonstrated that the modern surface of Mars is still experiencing a diverse suite of geomorphic processes, which both rework ancient, and develop new, features. This project will yield insights into the nature and rates of these geomorphic processes from ancient and modern Mars through the application of state of the art terrestrial topographic analysis techniques to the Martian context for the first time. The analysis of high resolution topographic data on Earth has led to fundamental insights into fluvial and hillslope processes, quantification of the impact of tectonics on surface morphology and tests for a range of theoretical sediment transport laws. This topographic analysis will be performed using LSDTopoTools (http://LSDTopoTools.github.io), a state of the art software package developed at QMUL in collaboration with colleagues from Edinburgh, Glasgow and Durham Universities. Full training in software development and the use of LSDTopoTools, alongside opportunities to collaborate with other users of LSDTopoTools, will be provided to the successful student. By combining these existing techniques with landscape evolution models and bespoke Martian topographic analysis methods developed by the student, a range of different topics can be explored, including (but not limited to): (i) Identifying hillslope-channel linkages; (ii) comparative Martian and Terrestrial fluvial network analysis; (iii) using crater wall morphology to infer modern erosion rates; (iv) inferring ancient Martian climate signatures through channel morphology.

By studying landforms created under climate extremes on Mars, we will develop better insights into the impacts our changing climate will have on landscapes and society.

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