Project title: Controls of EPS distribution in deep sea canyons and implications for carbon budget (Ref: OP2160)

Keywords: Organic matter transport, biofilm, EPS, clay

One Planet Research Theme:
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☐

Lead Supervisor: Dr. Sanem Acikalin

Key Research Gaps and Questions:
- organic matter and EPS transport mechanisms to deep sea
- role of EPS on nutrient transport
- understanding EPS distribution in submarine system

Project Description: Powerful seafloor sediment flows called turbidity currents form the largest sediment accumulations, deepest canyons and longest channels on Earth. These flows transfer vast amounts of detrital sediment and organic carbon to the deep sea. A cohesive substance formed by microorganisms, called extracellular polymeric substance (EPS) is part of this mixture, and makes up the 40% of total organic carbon transported to the deep sea (1). EPS is adhesive and hence facilitates clay flocculation, formation of clay-coated sand grains and binding of organic matter and nutrients to sediment (1, 2).

Our previous study at Bute Inlet (BC, Canada) provided exciting new insights into EPS and organic carbon transport mechanisms by turbidity currents. For example, the majority of EPS is formed by benthic diatoms, probably at the delta top, and transported to deep-sea (600m water depth) by turbidity currents. Such efficient transport of EPS and organic matter to deep sea provides additional nutrient to distal lobes, situated at submarine channel mouths. High influx of organic matter and EPS-bound nutrients may facilitate unexpected ecosystem development in these areas, such as the localised communities at distal lobe that lies beyond the termination of the Congo Canyon (3).

This PhD project aims to understand EPS related organic carbon budget and nutrient transport pathways to deep-sea. The project will utilise a comprehensive sample set collected on 2019-Congo Cruise funded by NERC (NE/R001952/1). In the context of this wider NERC project, there will be opportunities to join a marine research cruise for data collection. In this project, various sedimentological and biological analytical techniques will be used (such as EPS quantification, grain size analysis, core logging, clay mineral identification, DNA sequestration, biomarker analysis) as well as statistics and quantitative modelling during the data interpretation.

The candidate will join the wider UK and international researcher community of the Congo Canyon project. This will provide opportunity to develop excellent communication and team player skills. Academic and analytical skills will involve understanding of carbon cycle, sediment transport processes and climate modelling as well as organic geochemistry, core logging, and clay mineralogy.


Prerequisites: An MSc degree in: Earth Sciences; Geology; Marine Sciences; Physical Geography. For more information, please contact Dr. Sanem Acikalin (sanem.acikalin@ncl.ac.uk).