

## NERC Centre for Doctoral Training in Oil & Gas (2017 start)

**Project Title: Internal architecture and external geometry of sand waves and contourite-influenced deposits offshore Senegal**

**Host institution: Institute of Petroleum Engineering, Heriot-Watt University**

**Supervisor 1: Dr. Uisdean Nicholson (HWU)**

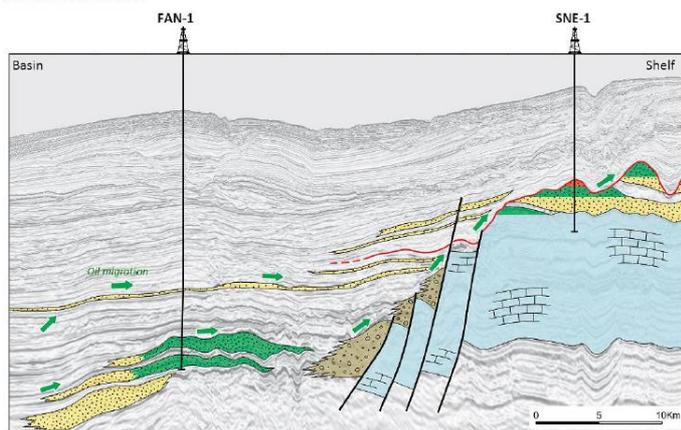
**Supervisor 2: Professor Dorrik Stow (HWU)**

**Additional Supervisor (s): Dr. John Clayburn (Cairn), Professor John Underhill (HWU), Dr. Dan Arnold**

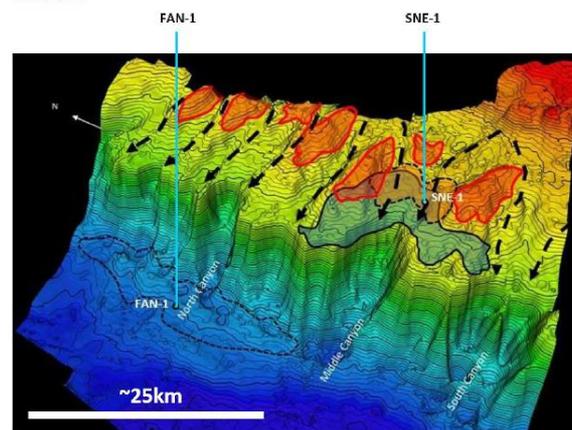
### Project description:

This PhD project will use cores, well logs, 3D seismic, drill stem tests (DSTs) and other data sources, including field and outcrop analogues, to examine the genesis of, and range of internal and external architectures of sand waves and contourite-influenced deposits offshore Senegal. Data will be available from two recent high-profile discoveries by Cairn Energy and partners (Figure 1), where the reservoirs appear to have been affected by bottom currents, and this project will help understand the impact of those processes on reservoir properties, and also on the prospectivity of these deposits more widely across the West African margin.

2D Seismic schematic



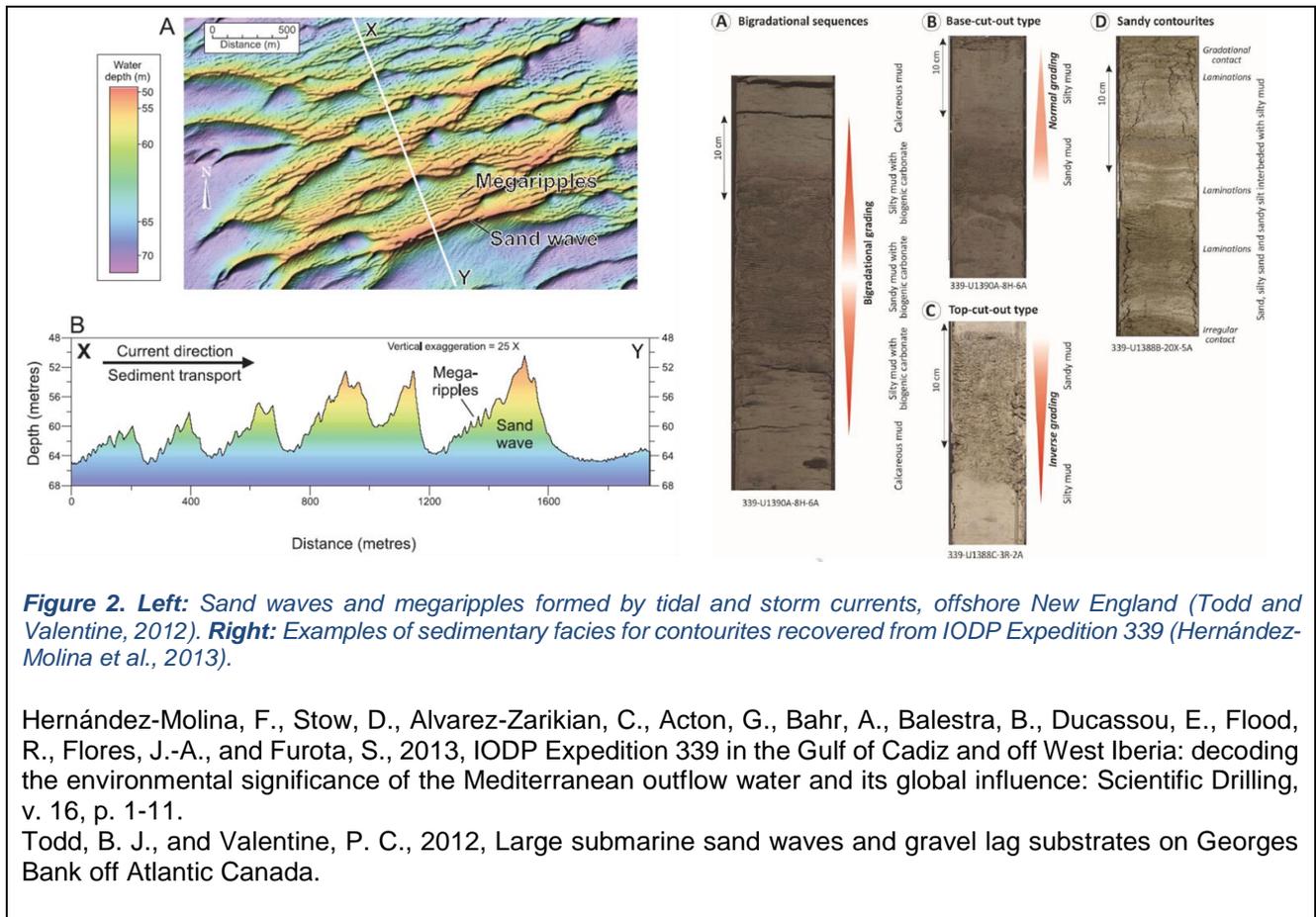
3D Seismic



**Figure 1.** Seismic section (left) and 3D image (right) of the two discovery wells offshore Senegal. Images courtesy of Cairn Energy

One of the specific goals of the project is to understand sandbody geometries, and the spatial distribution of permeability and pore space connectivity of these deposits. Observations made from logs, cores, seismic and analogue datasets (Figure 2) will be used to build a series of models capturing the properties and uncertainties of these sediments as outlined (architecture, external and internal), including the range of permeability distribution. These can ultimately be used as inputs for static and dynamic reservoir models that capture the observations and uncertainties, which will help with fluid flow predictions and likely hydrocarbon recovery under different development scenarios, and ultimately the commercial viability of the discoveries.

The study will also form part of a broader investigation into the controls on the nature, formation and internal architecture of sediment waves, in particular those formed on delta front ramps, in deep-water settings and on contourite-influenced shelf-margin deposits. In order to do this, the deposits need to be understood in their seismic stratigraphic and palaeogeographic context, to help build on existing models of contourite reservoirs in different settings – models that are currently based on limited data, and which remain poorly calibrated. Thus there is real scope to make a fundamental contribution to a poorly understood subject area within sedimentology.



**CDT Research theme(s): Exploration in Challenging Environments**

**Research context:** Comparing these deposits to published literature, with new interpretations of outcrop and analogue field data and the construction of appropriate reservoir modelling techniques to mimic fluid flow would potentially provide the sort of direct research unlikely to be carried out in sufficient detail by the Sangomar consortium but could influence real value during production timeframes. It would give the student exposure to the oil and gas industry as well as doing ground-breaking research in an area largely ignored by industry and academia. The project complements existing PhD students and their projects in the Institute of Petroleum Engineering at HWU.

**Research costs:** All the key budget costs for hardware, software, data purchase, field and lab costs are covered either by the NERC RTSG or as part of the support from HWU. Data will be provided by the Sangomar consortium through Cairn as the operator, with permission from Petrosen and the JV.

**Career routes:** Oil and Gas companies as Geoscientists or Reservoir Engineers, or an academic career in sedimentary geology. Alternatively other areas of Geoscience requiring research and analytical skills and project management.