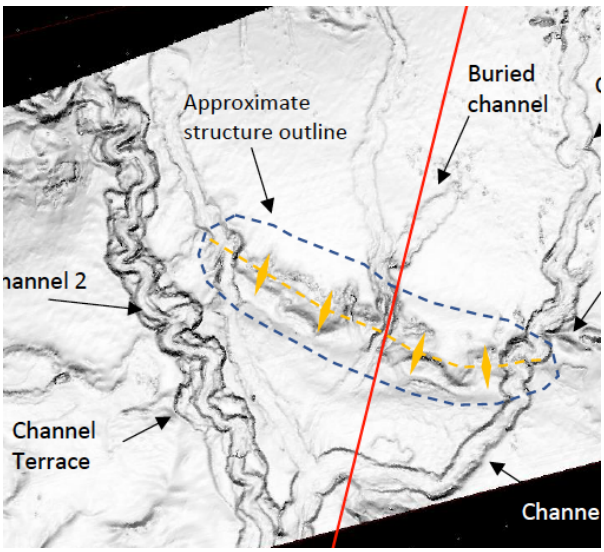
Title: Submarine channels, structural deformation and sediment delivery to the deep ocean
Supervisors: Lidia Lonergan, Alex Whittaker and Mike Mayall, Imperial College London,

Summary: Submarine channels are the main conduit by which sediment eroded from the continents is transported to the deep sea. Volumetrically, they are the most important sediment transport process on our planet, and they give rise to the largest sediment accumulations on Earth - submarine fans. Predicting the pathways and behaviour of these channels is therefore critical for constraining sediment budgets in the geologic past and for understanding the transfer of sediments and micro-plastics to the sea floor. passive margins, where thick wedges of siliciclastic sediments are additionally deposited on muddy substrates as gravitationally-unstable deltaic deposits, a key complexity is the tendency for these sediments to deform under their own weight, giving rise to a dynamically-deforming seabed. Submarine channels will interact with this structurally-controlled bathymetry, giving rise to an intricate pattern of sediment dispersal to the ocean floor. However the interactions and feedbacks between structural deformation, erosion and sedimentation in the marine realm have until recently been poorly understood. This project will use recent insights derived from the deep-water Niger Delta combined with a new seismic and well data set for the JDZ region of Nigeria & São Tomé e Príncipe to quantify sediment pathways and sediment facies distributions across a deforming passive margin.



In the JDZ zone, the 3D seismic data provided for this study from PGS shows there are several thrust structures active at the seabed, a number of seabed channel systems and a chrono-stratigraphic framework from well data. The student will (i) calculate structural growth rates for all faults in the area; (ii) forensically document the response of the submarine channels systems to time-integrated structural growth; (iii) quantify morphological evolution of recent and shallowly buried in the JDZ area using the techniques developed at Imperial; (iv) evaluate the impact of structure and sediment routing and sedimentary architecture; and (v) develop a generalised, predictive model of submarine channel response to growing structure. The student will also have the opportunity to compare their results to geological field analogues in the Ainsa and Jaca basins in Spain where they will quantify preserved channel dimensions and architectures.

Training: The student will join a strong research group in Imperial College with well-established strengths in structural analysis, 3D seismic interpretation, sedimentology and tectonic geomorphology. Training will be given in industry-standard computer software techniques for 3D seismic interpretation, and ARC-GIS. As part of the Graduate School of Engineering and Physical Sciences, the student will attend a series of transferable skills courses to equip her/him with research and communication skills.

To Apply: Please contact Lidia Lonergan (l.lonergan@imperial.ac.uk) or Alex Whittaker (a.whittaker@imperial.ac.uk) including a CV with your course grades with your email. The closing date for NERC funded PhD studentships is 4 January 2021; eligibility requirements for this funding can be found here- https://www.imperial.ac.uk/grantham/education/science-and-solutions-for-a-changing-planet-dtp/studentship-opportunities/. Overseas students are also welcome to apply.

References

Jolly, B.A., Whittaker, A.C, Lonergan, L. 2017. *Geol Soc Am. Bull.* 129, 1123-1139. Jolly, B.A., Lonergan, L., Whittaker, A.C. 2016. *Mar. Pet. Geol.* 70, 58-76. Mitchell, W. H., Whittaker, A. C., Lonergan, L., Mayall, M., Quantifying the relationship between structural growth rate and the morphology of modern submarine channels on the Niger Delta continental slope, *Basin Research; DOI: 10.1111/bre.12460; Pizzi, M., Lonergan, L., Whittaker, A.C. & Mayall, M. 2020. Growth of a thrust fault array in space and time: an example from the deep-water Niger Delta. Journal of Structural Geology, 10.1016/j.jsg.2020.104088*