Where does the mud go in turbidite systems and why does it matter?

A PhD studentship to be run by the Turbidites Research Group in the School of Earth and Environment at the University of Leeds

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Summary

- Opportunity to undertake fieldwork in stunning settings, such as the Maritime Alps (France) and the Ligurian coast (Italy).
- Learn and apply the most recent and cutting-edge techniques in quantitative sedimentology.
- Join an integrated research group, with linkage to international research associates and industry
- Attend international conferences in the Europe, the US and elsewhere
- Project sits alongside linked research as part of a larger programme
- Tutoring in career development (academia, industry and beyond)

Sediment driven gravity flows dominate sediment transport into many parts of the deep oceans, where they build submarine fans, the largest sediment accumulations on Earth. For decades only two types of such flow were recognised: dense, laminar debris flows (commonly muddy, with minor sand) and dilute, turbulent turbidity currents (commonly carrying sand and mud). Turbidity currents were thought to evolve from debris flows through flow dilution. Since the early 2000s, however, it has become evident that flow evolution can be far more complex and that mud plays a key role. In particular flows of intermediate character are known to occur, whose deposits are common, complicated and difficult to predict. At their simplest, such beds are characterised by the association of a basal clean sandy division resembling a turbidite and an upper a chaotic muddy unit resembling a debrite, emplaced as part of a single flow event (Haughton et al., 2009). A number of studies have described such “hybrid events beds” and some general models for their generation have been proposed (e.g. Talling, 2013). However, why they are abundant in some systems and absent in others is still largely unknown – although both field and laboratory studies are starting to suggest that how flows acquire mud, its character, and where it is acquired are important. The project will research these effects by combining sedimentological fieldwork to acquire data from ancient turbidite systems with a quantitative databasing approach to gather and analyse the available published data from the scientific literature.

Eocene-Oligocene Peïra Cava turbidite system, Alpine Tertiary foreland basin, French Maritime Alps, one of the planned field areas.

Aims and Objectives

- Characterise hybrid event beds in a number of ancient turbidite system, applying traditional fieldwork and cutting-edge techniques in quantitative sedimentology.
- Compile available information on an additional number of systems by mining the published literature and with the use of databases to aid statistical analysis.

The aims of this project are to document the variable occurrence of hybrid event beds in turbidite systems and to investigate what are the key controlling factors. These goals will be achieved thorough the combination of two research approaches. Sedimentological fieldwork in ancient turbidite successions will provide the basis for: i) hybrid event beds recognition and classification, with the objective of devising criteria for distinguishing different types of hybrid event beds (building on existing models) and ii) quantifying hybrid event bed types, location and proportions within individual systems. This approach will be complemented by the gathering of available data from published literature on the occurrence and character of hybrid event beds. The data will be organised and queried using a database-approach, using DMAKS (the “deep marine architecture knowledge store”), an architectural and facies database for deep-water clastics deposits. Thus the immediate objective of this part of the project will be to compile a database of hybrid beds, detailing i) their character, ii) their proportion within their hosting system, and iii) the range of controlling factors associated with the hosting system.

Eligibility. Applicants should have a BSc degree (or equivalent) in geology, earth sciences, geophysics or a similar discipline. An MSc or MGeol in applied geoscience or petroleum geoscience (or similar) would be an advantage. Skills in field-based geological data collection and field sedimentology and stratigraphy are desirable. Experience of using GIS software would be useful, though is not essential.

The 2018 TRG European sponsors meeting excursion to the Cretaceous-Palaeocene Gottero System, Ligurian coast, NW Italy.

Training. The successful applicant will join the inter-disciplinary Turbidites Research Group, which is part of the wider Sedimentology Group at the School of Earth and Environment, University of Leeds. The TRG has graduated 24 PhD students to date, and has twelve on-going research projects related to deep-marine clastic sedimentology via field studies, physical and numerical modelling and seismic studies (https://trg.leeds.ac.uk/page-people.php). The project provides specialist scientific training in: (i) field-based techniques for the sedimentological and architectural analysis of clastic successions; (ii) relational-database theory and practice; (iii) statistical analysis. In addition, the successful PhD student will have access to a broad spectrum of training workshops provided by the Faculty that include an extensive range of training workshops in statistics, through to managing your degree, to preparing for your viva (http://www.emeskillstraining.leeds.ac.uk). The successful candidate will be strongly encouraged to publish the outcomes of their research in leading international journals.

References

Haughton, P. D. W., Davis, C., McCaffrey, W. D. and Barker, S. (2009). Hybrid sediment gravity flow deposits - Classification, origin and significance. Marine and Petroleum Geology 26(10): 1900-1918.

Talling, P. J. (2013). Hybrid submarine flows comprising turbidity current and cohesive debris flow: Deposits, theoretical and experimental analyses, and generalized models. Geosphere 9(3): 460-488.

Further Information

For more information about this project and other TRG activities contact:
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