Anatomy of early continental rifting: An integrated pedofacies, spectral gamma ray (SGR) and paleomagnetic approach

Almahdi Alshawib & Dr Chris Nicholas

alshawia@tcd.ie nicholyj@tcd.ie

Department of Geology, School of Natural Sciences, Trinity College Dublin, the University of Dublin, Dublin 2, Republic of Ireland.

Background Rationale

Hydrocarbon exploration in offshore 'Atlantic Ireland' rift basins carries significant risk for a number of different reasons and currently remains overly-dependent upon seismic surveys and their interpretation. Finding and documenting high-resolution, onshore analogue examples of continental syn-rift sedimentary lithofacies architecture and depositional styles will potentially help de-risk exploration in these basins in the future.

Continental Rifting in Action: Pleistocene – Recent Sedimentary Environments in the Lakes Albert and Edward Basins

Initially, legacy SGR data and samples from previous extensive geological field surveying by the FI of the Lakes Albert and Edward basins, Albertine Rift, East African Rift System (Figures 1 & 2), were re-analysed and re-interpreted to identify and provide an atlas of key modern-day depositional palaeo-environments and their spectral gamma ray responses.

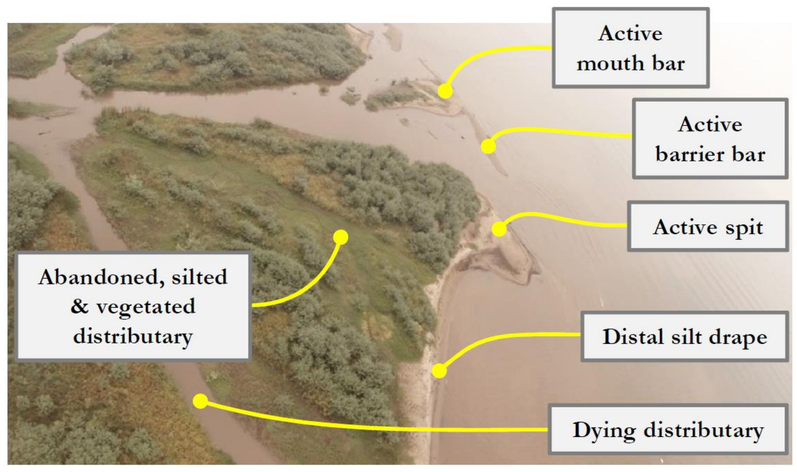


Figure 1. Juvenile Long-Axial Delta System, modern-day Lake Edward.

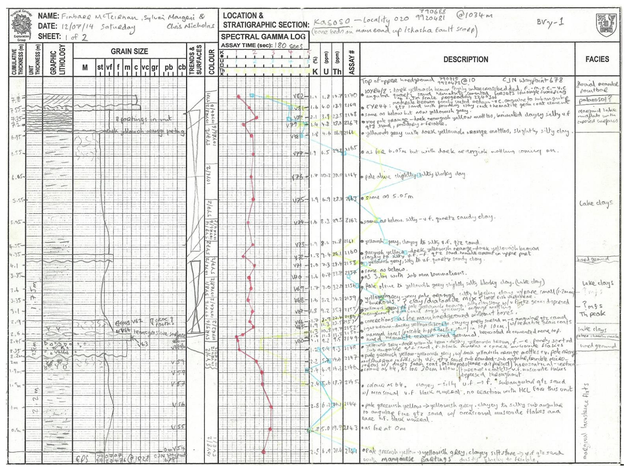


Figure 2. Capturing the SGR response of a marginal lacustrine section in the field, Lake Edward.

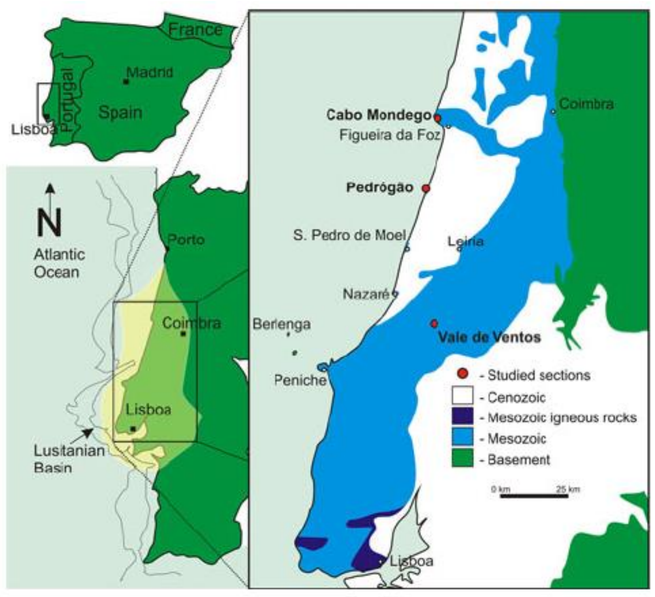


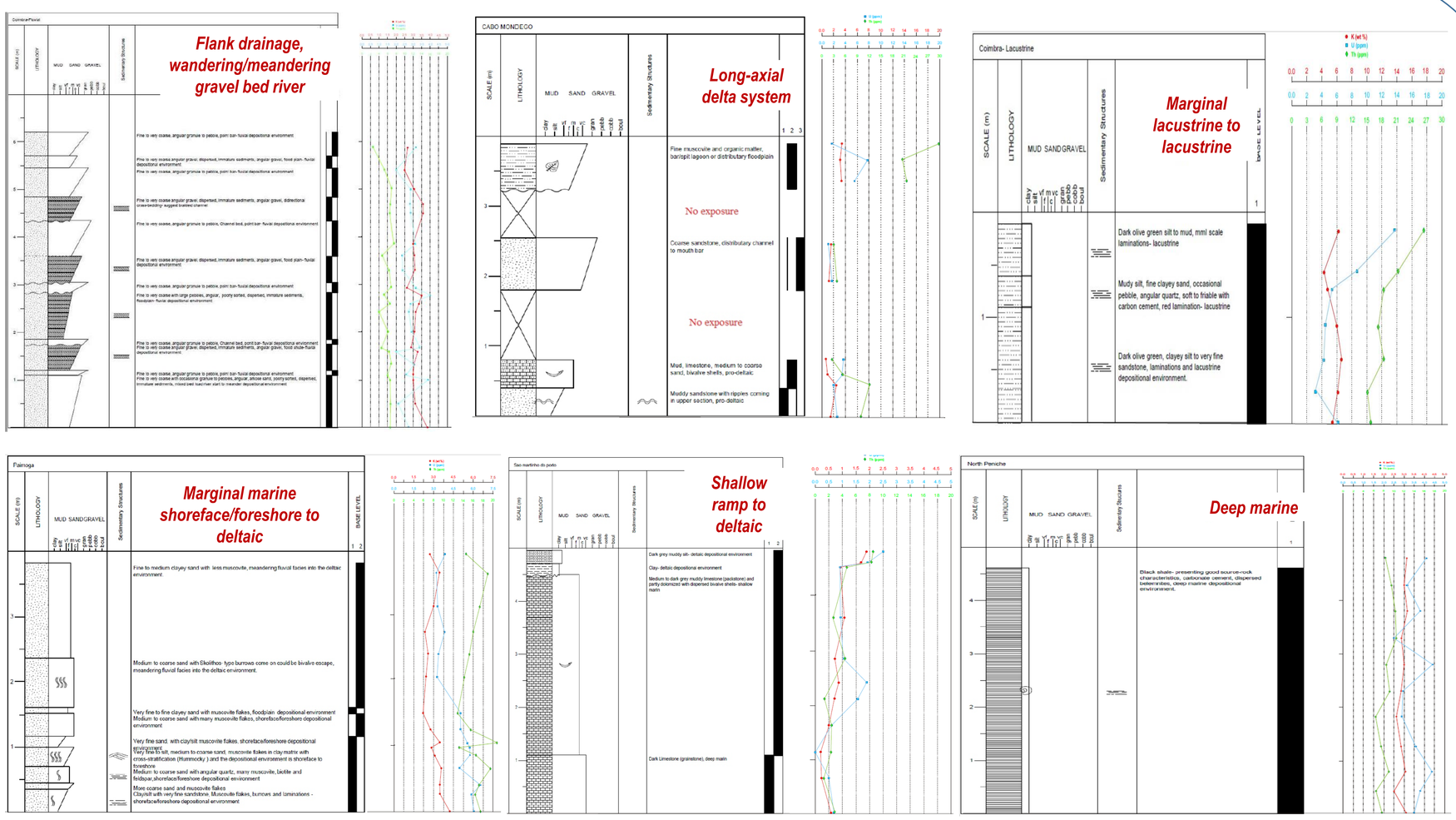
Figure 3. The location of the Lusitanian Basin, Portugal (modified from Silva, 2014)

Lusitanian Basin, Portugal

Once the characteristics of modern-day rift sedimentation were established, the research focus moved towards finding an age-equivalent onshore rift basin for Irish offshore basins. The Lusitanian Basin, Portugal (Figure 3) appears to exhibit all the classic tectonic, sedimentary, geomorphological and hydrological features of the early to mid stages of continental rifting. As the geographically closest Atlantic rift basin to offshore Atlantic Irish basins, it potentially could be used as a direct onshore analogue for the Porcupine and North Celtic Sea Basins as they are of a similar structural size, style and age to the Lusitanian Basin, with syn-rift deposits of Late Triassic to late Jurassic age and fluvio-lacustrine to deep marine deposits. This poster concentrates on presenting work in progress, of recent results of initial field work in the Lusitanian Basin and displays the high-resolution sedimentary fluvio-lacustrine pedofacies and marine deposits and their spectral gamma ray response, developed during early to mid continental rifting in the Lusitanian basin. Once a more detailed and comprehensive study has been made to categorise these palaeo-environments in Portugal, the results will be compared and contrasted with the well log responses from both the North Celtic Sea and Porcupine basins, and their high resolution depositional palaeo-environments re-interpreted.

SGR Logging in the Lusitanian Basin

Spectral gamma ray logging has been undertaken of representative examples of sedimentary sections which have previously been interpreted to have been deposited in a spectrum of palaeo-environments from fluvial, deltaic and marginal marine through to deeper marine.



Conclusions

- The initial data from the Lusitanian basin are encouraging and a more detailed field work programme will be undertaken during the course of summer and autumn, 2019.
- There exists a real opportunity to complete a thorough and detailed re-interpretation of offshore Atlantic Ireland wells and their depostional palaeo-environments.

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