

Andrew Whitham CASP Fieldwork Awards 2024 – Winner

Applicant: Victor Hème de Lacotte

Project title: Stratigraphic model for aeolian-marine margins: implication for subsurface CO₂ migration and trapping

Award: £4,000

Scientific question and rationale: What defines an aeolian-marine margin sequence and by what key stratigraphic surfaces is it framed? What allocyclic controls can be deciphered from such sequences after filtering out autogenic signal overprint? How can multi-scale architectures arising from aeolian-marine interactions influence subsurface CO₂ flow pathways?

Specific objectives and deliverables: 1) Identification of facies-scale sedimentary architectural products driven by autogenic process occurring in arid coastal environments. Deliverable (D): classification scheme for sedimentary architectures arising from aeolian-marine interactions. 2) Recognition of key stratigraphic surfaces produced through transgression-regression cycles over an erg margin. D: Fundamental aeolian cyclicity model applied to coastal erg margins and for different allocyclic forcing mechanisms. 3) Linking allogenic signatures from distal marine settings to erg centres and identifying their expression at the transition between the two systems. D: Constrained and generalised sequence stratigraphic framework for aeolian-marine margins. I am here applying for the A. Whitham CASP grant in the scope of achieving that last third point, which goes beyond the scope of my PhD and which would involve a collaboration with multiple international institutions (USGS, BGS, University of Utah, Aachen University, University of Aberdeen).

Proposed work plan: Contemporaneous shallow marine and aeolian deposits of the San Rafael Group (Jurassic) cropping out along the Colorado Plateau in western USA have been selected as perfect analogues to develop the stratigraphic model discussed herein above. Through two successive transgression events, the Sundance Sea deposited mixed siliciclastic-carbonate sediments across an arid coastal ramp at the edge of an endorheic basin enclosed by topographic highlands (Carmel Formation, Curtis Formation, Sundance Formation). Regressive events were dominated by dune-field encroachment (Page Sandstone, Entrada Sandstone) over coastal sabkhas (Preuss Formation, Summerville Formation). This ancient analogue has been chosen because of the exceptional outcrop exposure in 3D characteristic of the Colorado Plateau as well as its historic research coverage. Diverse sets of data have been collected throughout recent fieldworks for different research projects, all documenting in fine detail parts of the San Rafael Group in Utah (e.g. *Zuchuat et al., 2019, Cross et al., 2023, Heme de Lacotte et al., 2023*). Data gaps have been identified and will be completed throughout the fieldwork, for which I seek funding. Constrained aeolian cyclicity analysis will be conducted in selected proximal sections by identifying significant aeolian sequences and super-surfaces at a basin-scale through sedimentary logging and drone photogrammetry (Location A: Bluff, Utah; location B: Page, Arizona). Gamma-ray data will be collected in the distal part of the basin where sediment accumulation rates are pseudo-continuous. A cyclostratigraphic analysis of the signal will inform a sequence stratigraphic interpretation of the distal sections (Location C: Bighorn Basin, Wyoming; Location D: Wind River Basin, Wyoming; Location E: Uinta Basin, Utah). Finally additional sedimentary logging will be performed at coastal sections where intertonguing of aeolian and shallow marine units occurs (Location E: Moab, Utah; Location F: San Rafael Swell, Utah).

Proposed expenditure, including details of any other sources of funding:

Total fieldwork time: 6 weeks. Number of people: 2 people.

Airplane tickets (Manchester-Denver, round trip): 2 p. x £750 = **£1500**.

Food supply: 2 p. x 42 days x £30 = **£2500**

Car rental: **£2100**

Fuel: 6 wks x £100 = **£600**

Accommodation: 42 days x £15 camp site = **£630**

Total: **£ 7350** which would include **£ 4000** from the A. Whitham CASP grant. The remaining **£ 3350** will be covered by my research bursary from the Centre for Doctoral Training (CDT) in Geoscience and the Low Carbon Energy Transition