**PhD studentship Project information**

**Funding Source:** CENTA DTP

**Proposed start date:** 25th September 2023

**Closing date for applications:** 11th January 2023

**Eligibility:** UK/International

**Department/School:** SGGE

**Supervisors:** PI: Dr. Arnoud Boom, [ab269@leicester.ac.uk](mailto:ab269@leicester.ac.uk)

Co-I 1: Prof. Jens Zinke, jz262@leicester.ac.uk

Co-I2: Kenneth Johnson, NHM London, UK, Kenneth Johnson k.johnson@nhm.ac.uk

**Project Title:** Last Interglacial to present heat, salt and nutrient variability in the Indian-Atlantic Ocean gateway from Eparses Islands (Indian Ocean) coral core geochemistry

**Project Description :**

**Project Highlights:**

* Unravel Last Interglacial to present ocean climate history from the remote Eparses Islands (Scattered Islands) in the western Indian Ocean, with cutting edge coral core geochemistry spanning several decades per time slice
* Undertake innovative climate and geochemical proxy data analysis and develop paleoclimate reconstructions of temperature, hydroclimate and nutrient dynamics for the southern Mozambique Channel feeding the globally important Agulhas Current
* Bring the palaeoclimate data from past warm and cold stages into context with anthropogenic climate change and compare with SW Madagascar coral records

**Overview**

Understanding the role of ocean circulation in shaping the patterns of ocean warming, salinity and nutrient transport remain key to predicting global and regional climate change, ocean nutrient cycling and ecosystem responses. Western boundary currents are vital bottlenecks modulating global heat and freshwater distribution, as well as nutrient dynamics. Currently it is not known to what extent anthropogenic warming and associated changes in the hydrological cycle and nutrient dynamics exceed natural variability linked to seasonal, interannual and (multi)decadal Indo-Pacific and Atlantic climate variability. In particular, we have little knowledge if anthropogenic climate change contributed to amplifying or dampening heat and freshwater transport along the southern Indian Ocean currents (South Equatorial Current; Mozambique Channel eddies) feeding the Agulhas Current (AC), one of the most powerful western boundary currents on the planet (Fig. 1). Ultimately, the AC will feed into the Atlantic Meridional Overturning Circulation (AMOC) via Agulhas leakage into the South Atlantic and therefore is a critical joke point in the global thermohaline circulation affecting global climate (Beal et al., 2011; de Ruijter et al., 2004).

Given the importance of vigorous, eddy-driven western boundary currents for nutrient transport between the shelf and open ocean in the Mozambique Channel (MC) and AC sustaining highly productive and highly valuable fishing grounds (e.g. Tuna; Chassot et al., 2019), it is of paramount importance to study the long-term trends and the full suite of variability in nutrient dynamics coupled to thermohaline properties under varying climate background conditions influenced by orbital cycles (present to past climate states).

Our proposed study, therefore, will address this key knowledge gap by developing modern (~1850-2019 A.D.) and fossil (Last Millennium to Last Interglacial) coral paleoclimate records at unprecedented sub-monthly resolution obtained from key sites within the tropical, low-latitude MC inflow and the southern MC outflow feeding the globally important AC (Fig. 1). We will use state-of-the-art analytical approaches to develop coral geochemical records which will be paired with climate model-derived (Kiel Climate Model) and observational estimates to unravel the climate and ocean dynamics influencing the MC-AC western boundary flow on a variety of society-relevant time scales.



**Figure 1** – Sea surface temperatures (austral summer; map from http://apdrc.soest.hawaii.edu/data) across the southwestern Indian Ocean with the major ocean currents forming part of the global surface thermohaline circulation route indicated: SEC: South Equatorial Current, EMC: East Madagascar Current, NEMC: North East Madagascar Current, AC: Agulhas Current, ACR: Agulhas Current return flow, MCE: Mozambique Channel Eddies. The Europa and Glorieuses archipelago coral locations (large yellow dot) and the region of dense SST observations (rectangular box) for the Agulhas Current are indicated. The region of Agulhas ring shedding (AR) indicates Indian-Atlantic ocean exchange of heat and salt thought to influence the AMOC. Coral data available for regional comparisons are indicated by a small yellow dot (JdN: Juan de Nova; MAY: Mayotte, Zinke et al., 2008; Ifaty, SW Madagascar, Zinke et al., 2014).

**References:**

Beal, L. M., et al. (2011) *Nature*, 472, 429-436

Biastoch, A., et al. (2009) *Nature*, 462, 495–498

De Ruijter, W. P. M. et al. (2004) *Deep-Sea Research Part I,* 51, 383-400

Duprey, N. et al. (2017) Marine Poll. Bull., 120

Chassot et al. (2019) *Rev Fish Biol Fisheries*, doi:10.1007/s11160-019-09569-9

Wang, X.T. et al. (2015) Geoch, Cosmoc. Acta, 148, 179-190

Zinke et al. (2008) *Geophys. Res. Let.,* 35, L23707

Zinke, J., et al. (2014a) *Sci. Reports*, 4, 4393

Zinke et al. (2019) *Biogeosciences,* 16, 695-712

**Funding details:**

NERC CENTA studentships are for 3.5 years and are funded by NERC. In addition to the full payment of your tuition fees, you will receive the following financial support:

* Annual stipend, currently set at £ 17,668 (2022/3 – new figures to be confirmed spring 2023)
* Research training support grant £8,000 (RTSG)

\* If you do not meet the criteria for UK Fees you will need to fund the difference between UK and International fees for the duration of your studies.

\* A limited number of top up studentships to fund the difference between UK and International fees may become available but are not guaranteed.

For more details of the CENTA consortium please see the CENTA website: [www.centa.org.uk](http://www.centa.org.uk) .

**Entry requirements:**

Applicants are required to hold/or expect to obtain a UK Bachelor Degree 2:1 or better in a relevant subject or overseas equivalent.

The University of Leicester [English language](https://le.ac.uk/study/research-degrees/entry-reqs/eng-lang-reqs) requirements apply where applicable.

**Application advice:**

To apply please refer to

<https://le.ac.uk/study/research-degrees/funded-opportunities/centa-phd-studentships>

With your application, please include:

* CENTA Application form - available to download on the How to Apply section of the above link
* CV
* Personal statement explaining your interest in the project, your experience and why we should consider you
* Degree Certificates and Transcripts of study already completed and if possible transcript to date of study currently being undertaken
* Evidence of English language proficiency if applicable
* In the reference section please enter the contact details of your two academic referees in the boxes provided or upload letters of reference if already available.

In the funding section please specify that you wish to be considered for Ref CENTA2-SGGE5-BOOM

In the proposal section please provide the name of the supervisors and project title (a proposal is not required)

**Project / Funding Enquiries to:** [**CENTA@le.ac.uk**](mailto:CENTA@le.ac.uk) **or** [**ab269@leicester.ac.uk**](mailto:ab269@leicester.ac.uk) **or** [**jz262@leicester.ac.uk**](mailto:jz262@leicester.ac.uk)

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