MOZAMBIQUE SHELF CORES – PHASE 1: CORE CURATION AND DESCRIPTION

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GOALS

- To describe the composition of the cores and quantify the different components, including corals, microbialites, rubble, carbonate sand.
- Examine the difference in composition of the (older) fringing reef that grew during the Late Glacial Maximum (LGM) and the younger reef at the edge of the Upper Terrace.
- Establish a robust age frame of reef growth with C_{14} dating.
- Start a sampling campaign for a comprehensive diagenetic and petrophysical investigation of the cores and produce preliminary data set.

INTRODUCTION OF UNIQUE DATA SET

The slopes above the newly discovered giant gas fields offshore Mozambique (Fonnesu et al., 2020) revealed a long fringing reef that crested at -94 m water depth. The reef started to grow during the Last Glacial Maximum (LGM) at approximately 24 kyrs and drowned during the subsequent deglaciation (Figure 1). The reef backstepped and formed a younger fringing reef that is the edge of the Upper Terrace (Figure 1). Such lowstand reefs have been cored in a few places around the world, including offshore the modern Barrier Reef and Tahiti (Camoin et al., 2006; Heindel et al., 2012, Vacchi et al., 2025, Webster et al., 2025). What makes the cores from Mozambique unique is the number of long cores drilled into the LGM reef as well

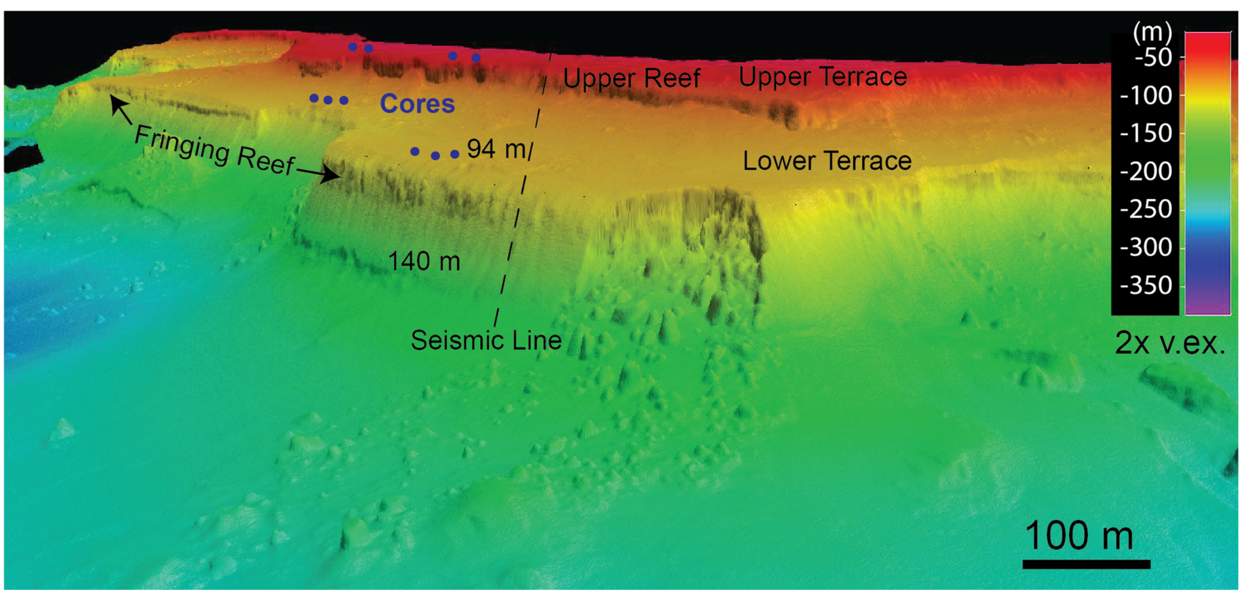

Figure 2: Approximate locations of the ten cores. Six cores were retrieved from the fringing reef along the Lower Terrace and four cores from the back-stepped reef forming the edge of the Upper Terrace.

as the cores from the Upper Terrace that retrieved a younger backstepped reef. Together these cores provide a unprecedent record of timing of LGM and the onset and rate sea level rise during the deglaciation.

INFORMATION EXPECTED FROM THE CORES

A 2 m section was made available to us a couple of years ago. It showed a diverse coral community with several species but also thick crusts of greyish microbialites, encrusting calcareous coralline algae and skeletal rudstone and grainstone (Figure 3; Tomchovska et al., 2022). Two samples collected for C-14 dating from this section yielded ages of 13,400 and 13,600 kyrs, documenting reef growth shortly after the LGM during the deglaciation and the sea-level rise event called Meltwater 1A.
The cores provided to us not only consist of two cores through the fringing reef but 10 cores from 6 sites (Figure 4). This expansive core coverage is most valuable for several reasons. First, the six long cores through the fringing reef will provide the lateral variability of the LGM reef growth and microbial encrustation but more

Component	Percentage of Surface Area
Coral	53.6%
Microbialite crust	14.1%
Calcareous coralline algae (CCA)	3.8%
Skeletal rudstone to grainstone	28.5%

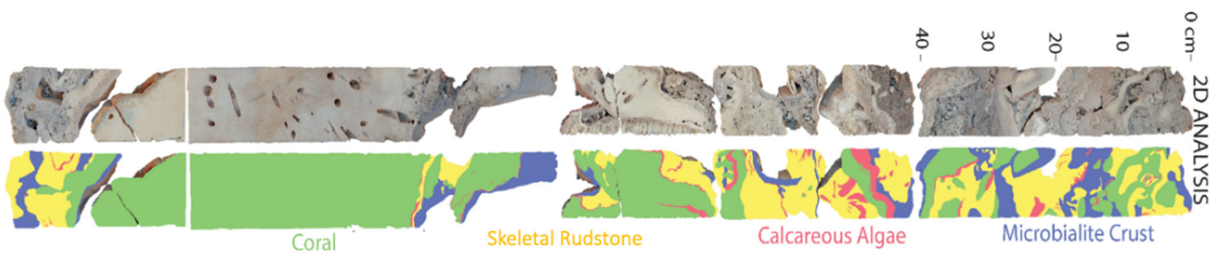

Figure 3: Quantitative analysis of the 2 m core section, displaying the four elements present and their respective abundance.

importantly will help to construct a robust time frame of the reef development during the LMG and the early deglaciation.

Second, the four cores through the younger reef on the Upper Terrace (Figure 1) offer the opportunity to examine the changes in reef composition during the Holocene sea-level rise and also to assess if the amount of microbial coating that is so prevalent in the LMG reefs (Camoin et al., 2006; Heindel et al., 2012) is decreasing with rising sea level. Furthermore, the six-fold coverage of the LGM reef allows to address many questions in a very comprehensive way, such as the evolution of the reefal community and the changes of the reef-building community towards the drowning, as well as the onset of microbial coating that is typical for LMG reefs. In addition, there will be enough material for comprehensive diagenetic and petrophysical studies.

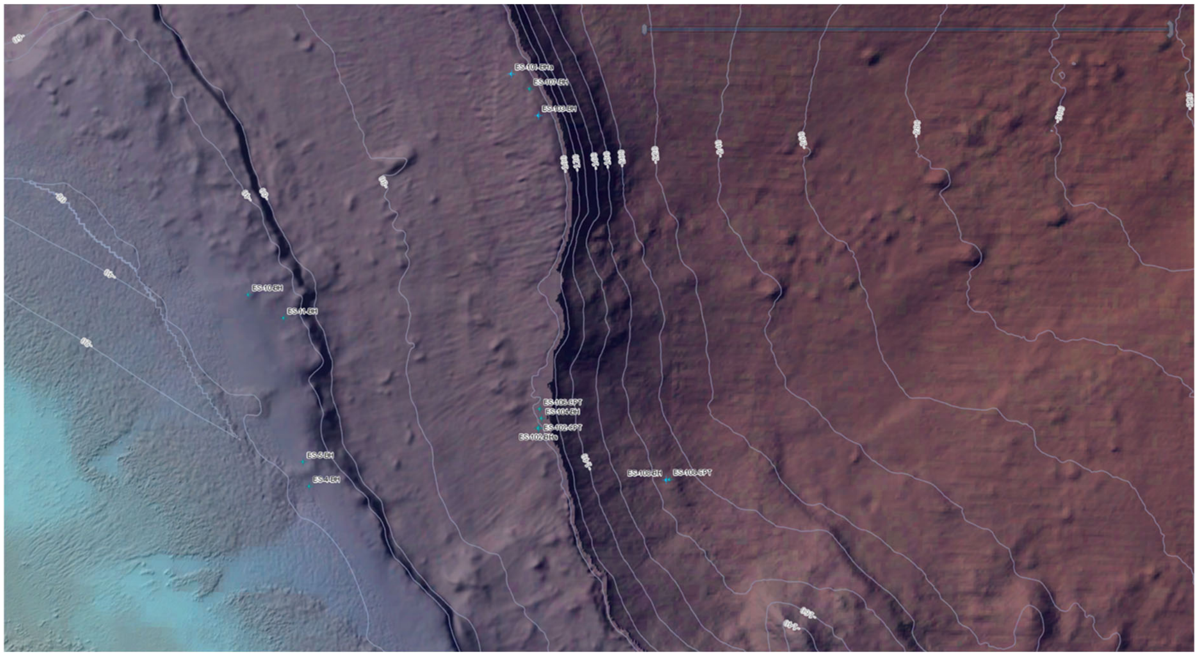

Figure 4: Bathymetry and locations of the 10 cores offshore Mozambique.

Work plan

After viewing and sorting the core material we decided to first work on core ES 103-BH, which is located on the edge of the LGM fringing reef and has a total core depth of 63.5 m. The core sections will be photographed and subsequently described. Cores will be cut and divided into a working half and archive half. Only the working half will be sampled for further analysis. Subsequently, all the other cores will be examined the same way.

In this first phase, the main goal is to describe the cores, cut enough thin sections to produce a petrographic analysis of the lithofacies and diagenesis. The description will include the identification of the coral species to capture the potential evolution coral ecosystem during the early sea level rise and eventual drowning. In addition, extensive amounts of samples will be taken to establish the age of the reef during the LGM and the onset of the deglaciation. Furthermore, samples for geochemical and petrophysical analysis will be taken. The analyses of these samples will be the focus of phase 2 but initial results will be produced on a subset of samples.

Expected Outcomes

With the help of international collaborators, we will provide a comprehensive description of the cores that includes

a) the amount and diversity of the coral species in the LMG and younger reef
b) the relative amounts of corals versus microbialites and reef rubble
c) age of reef during the LGM and the onset of deglaciation as well as the timing of the backstepping of the reef.
d) Initial results on the diagenesis and petrophysical properties.

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