

**Study Objectives:** In order to better quantify the role of climate variability in southeastern Africa, and its impact on the spread of anatomically modern humans, our international and interdisciplinary team cored a series of coastal lakes during the summer of 2019. This work seeks to present the results of Carbon, Hydrogen, Nitrogen (CHN) elemental analysis, and mollusk species distribution from lake Nyalonzelwe, one of many interdunal lakes present along the coast in the Inhambane region of southeastern Mozambique. Together these data represent a first look at late Quaternary paleoenvironmental evolution in southeastern coastal Mozambique, the importance of climate (in)stability in the region, and its impact on modern human populations.

Study Area: Lake Nyalonzelwe sits 5m above MSL and is bounded by a coastal dune system, reaching between 29-121m in elevation, protecting the lake from the Indian Ocean. In the Inhambane province, a series of Pleistocene sand-dunes are cut by fluvial and elongated lagoon depressions, preserving the orientation of the original dune system formed along a migrating shoreline.



Methods: Two cores, C1 and C4, with depths of 6.12m and 6.23m respectively, were collected for multiproxy biogeochemical analyses and C<sup>14</sup> dating using a Livingstone corer. CHN analysis was conducted using an Elementar model Vario EL III at the University of Algarve CCMAR for both organic and inorganic carbon present in sediment samples from C1. Nyalonzelwe cores C1 and C4 are stratigraphically correlated.

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## Biogeochemical analysis of newly dated lacustrine cores: a first look at Quaternary paleoenvironment in coastal Mozambique

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> Nyalonzelwe Core Stratigraphy: The sedimentological record of Nyalonzelwe presents over 6m of stratigraphic variability, including a varve sequence spanning the basal 2m. The oldest date on the core is 7460calBP.

CalBl dates	P s	
<u> </u>		
0	0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 70 - 80 - 90 - 100 - 110 - 120 - 130 - 140 - 150 - 140 - 130 - 140 - 150 - 160 - 170 - 170 - 180 - 190 - 1	A: Mud and Organic Material. Some <i>Melanoides</i> <i>tuberculata</i> (<1.5cm) present. B: Bioclast rich zone; <i>Melanoides</i> <i>tuberculata</i> dominant mollusk species with few micro-mollusks ( <i>Bellamya sp.</i> ) present. Matrix composed of mud and organic material.
	190 - 200 - 210 - 220 - 230 - 240 - 250 - 260 - 270 - 280 -	C: Grey banded muds with high organic matter. Bioclast (gastropod) rich zone with few carbonate laminations (~0.5-1mm thick)
3840	C) 290 - 300 - 310 - 320 - 330 - 340 - 350 - 360 - 370 - 380 -	D: CaCO <sub>3</sub> Layer E: Grey mud laminations interspersed with organics and bioclasts. Micro-mollusks ( <i>Bellamya sp.</i> and <i>Eussoia sp.</i> ) make up the bulk of the mollusk assemblage at this point in the core. <i>Melanoides</i> <i>tuberculata</i> in this area are larger (up to 3cm). F: CaCO <sub>3</sub> Layer G: Soft varves with organic laminations with
	390 - 400 - 410 - 420 - 430 - 440 - 450 - 460 - 470 -	micro-mollusks.   H: Soft varves with organic laminations interspersed throughout. Coloration: reds, greys, black. Micro-mollusks present across this section.
5480	480 - 490 - 500 - 510 - 520 - 530 - 540 - 550 - 560 - 570 -	I: Solid varves with organic clay laminations interspersed throughout.
7460	580 - 590 - 600 - 610 - 620 - 630 -	J: Crystalline mud layer. K: Light-grey clays on top of a CaCO <sub>3</sub> layer and varved sequence (basal 5mm).
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Macro-mollusk assemblage in the Nyalonzelwe core include bivalve Mactra sp. and gastropoda Melanoides tuberculata. Micromollusks are far more abundant, Bellmaya sp. and Eussoia sp. dominate gastropod assemblage of the basal  $^{2}/_{3}$ of the core. In the upper 200cm, Bulinus sp. appears with M. tuberculata.

Findings:			
2.0	<b>~2kyBP-</b> Archaeol O-1.4kya this		
	0		
	500		
<u><b>2kyBP-Present:</b></u> C/N ratios appear largely mixed	1000		
(terrestrial and aquatic sources).	1500		
<b>3.5-3kyBP:</b> C/N	2000		
ratios peak indicating a	2500		
terrestrial source.	3000		
3.75kyBP: C/N ratios indicate an	3500		
algal or aquatic source.	4000		
<u>5.2-4.7kyBP:</u> C/N	4500		
ratios indicate an aquatic source.	5000		
6.5-6kyBP: C/N	5500		
algal or aquatic source. Until	6000		
6kyBP where the C/N ratio shifts	6500		
drastically towards terrestrial input.	7000		
<b>6.6-4.4</b> C/N rat	<b>cyBP:</b> inc tios whic organic		
	organic		
Future Research: Due to labo Nyalonzelwe mollusks. Future Mollusks, (2)stable Isotope ar			

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<sup>1</sup>Gomes et al. (2019). Quaternary Paleoenvironmental Changes in the Inhambane Bay (Southeastern Mozambique). 84<sup>th</sup> Annual Meeting of the Society for American Archaeology, Albuquerque, USA. tDAR-ID: 452014. <sup>2</sup>McWethy et al. (2016). Late Quaternary vegetation development and disturbance dynamics from a peatland on Mount Gorongosa, central Mozambique. Quat.Sci.Rev.137: 221-233

<sup>3</sup>Semo et al. (2019). Along the Indian Ocean Coast: Genomic Variation in Mozambique Provides New Insigipts into the Bantu Expansion. Mol.Biol.Evol.37(2):406-416.



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esent: organic and inorganic carbon values diverge (remaining anti-phased I<sup>2</sup> and recent genetic data on the Bantu expansion<sup>3</sup> suggest that betwee y agriculture was introduced and adopted in southern Mozambique. Thu eak in organic carbon is likely indicative of anthropogenic agricultural inpu



nic and organic carbon inputs are synchronous. The low organic carbon content correlates to th re dominated by algal or aquatic inputs. The correlation between low organic carbon and aquat oon peaks and C/N shifts towards terrestrial inputs, could be indicative of an evaporative system

pratory closures as a result of COVID-19, we were unable to complete the FT-IR analysis of research for this project will include: (1)completion of Aragonite Calcite ratios of Nyalonzelwe nalysis of Gastropods and bulk sediment to complete paleo-precipitation reconstruction, and (3)TEX86 analysis of bulk sediment samples for paleotemperature reconstruction.



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