BENTHIC FORAMINIFERA AS INDICATIVE OF AUSTRAL SUMMER MONSOON PRECIPITATION AND WINTER MONSOON WIND-DRIVEN UPWELLING

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INTRODUCTION

During IODP (International Ocean Discovery Program) Expedition 363, in the western Pacific warm pool (WPWP), a hemipelagic sediment succession were retrieved for the first time off NW Australia (Site U1483: 13°5.24'S, 121°48.25'E with sedimentation rate:~10 cm/kyr) spanning upper deep waters (1733 m). We investigate the potential of down-core variations in benthic foraminiferal species composition in relation to depth, temperature, and nutrient sensitive species, to record paleo environmental conditions of the bottom waters as a measure of carbon flux rate.

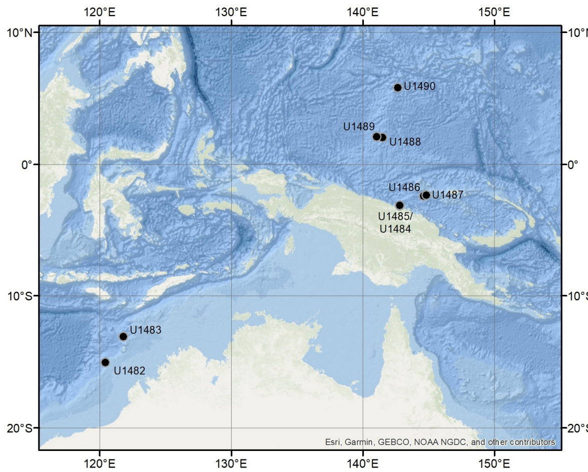

Figure 1. Study area and location of nine cores (U1482-1490) collected in the WPWP. Site 1483 is the core investigated in this study.

MATERIAL and METHODS

Total benthic foraminiferal assemblage composition was based on counts of all benthic foraminiferal tests from the >150 µm size fractions. From each interval, we identified deep versus shallow water species using the bathymetric scheme of Morkhofen et al. (1986). This carbonate- and clay-rich sequence provide ideal archive to monitor intensity and variability of the Australian Monsoon (AM), to better constrain its sensitivity to changes in radiative forcing. Due to the location at the southern edge of the largest amplitude seasonal swing of the Intertropical Convergence Zone (ITCZ) within the large-scale Asian-Australian monsoon system, the AM subsystem is sensitive to tropical hydroclimate variability.

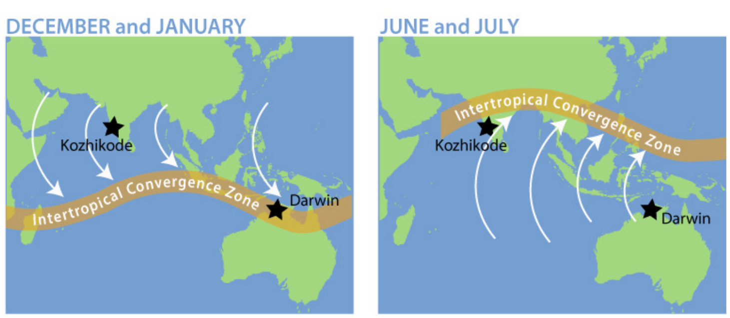

Figure 2: As the Intertropical Convergence Zone (ITCZ) changes location through the year, the winds, rains, and the location of wet monsoon weather changes, too. In this example from Asia and Australia, the ITCZ moves from the Southern Hemisphere (left map) to the Northern Hemisphere (right map). (Images: UCAR)

However, this sensitivity to changing climate boundary conditions such as ice volume and greenhouse gas concentrations remain poorly understood across the Calabrian, in the Pleistocene Epoch.

Figure 3: Showing Calabria, a subdivision of the Pleistocene Epoch of the geologic time scale, defined as ~1.8 Ma.—781,000 years ago ± 5,000 years, a period of ~1.019 million years. The end of the stage is defined by the last magnetic pole reversal (781 ± 5 Ka) and plunge into an ice age and global drying possibly colder and drier than the late Miocene (Messinian) through early Pliocene (Zanclean) cold period.

Subdivisions of the Quaternary System

System	Series	Stage	Age (Ma)
Quaternary	Holocene		0–0.0117
	Pleistocene	Tarantian	0.0117–0.126
		Ionian	0.126–0.781
		Calabrian	0.781–1.806
		Gelasian	1.806–2.588
Neogene	Pliocene	Piacenzian	older

RESULTS and DISCUSSION

Benthic foraminiferal assemblage show records of terrigenous runoff (Austral Summer monsoon precipitation) with presence of shallow, fresh water-tolerant to transitional environments *Bolivina striatula, Buliminella elegantissima*, *Dentalina* spp., *Oolina* sp., and paleo productivity (winter monsoon wind-driven upwelling) from 1.34 Ma. through 1.61Ma. with *Melonis* spp. This species is present in 4 out of 5 PCA axes; prefers organic matter in a more altered form, and migrates in the sediment depending on the quality of the organic matter supply and remineralization, which indicates surface upwelling during this time. The genera *Stilostomella* spp. is present in 3 out of 5 axes, and it is indicative of Intermediate water temperature. Our study suggest changes in the global ice volume, interhemispheric thermal gradient exchange, and response of the ocean/climate system to radiative forcing, offering a great opportunity to study climate-carbon cycle dynamics and its link to climate variability. These records will be compared to C org wt (%), TN wt (%) and the isotope ratios to help discovery fauna patterns, responses and adaptation to global climate change.

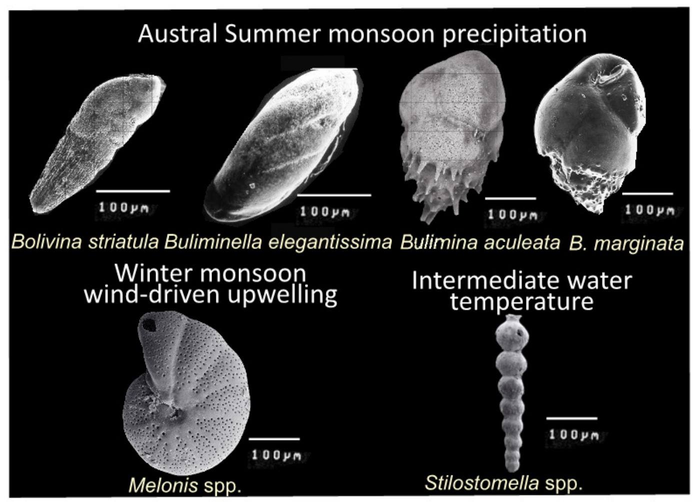

Figure4. Main foraminiferal species.

CONCLUSIONS

Our study suggest changes in the global ice volume, interhemispheric thermal gradient exchange, and response of the ocean/climate system to radiative forcing, offering a great opportunity to study climate-carbon cycle dynamics and its link to climate variability. These records will be compared to C org wt (%), TN wt (%) and the isotope ratios to help discovery fauna patterns, responses and adaptation to global climate change.

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Our work encompasses 10 sustainable development goals, among which are: 4. Quality Education, Ensuring quality inclusive and equitable education, and promoting lifelong learning opportunities for all; 6. Drinking Water and Sanitation, Ensure availability and sustainable management of water and sanitation for all; 7. Clean and Accessible Energy, Ensure reliable, sustainable, modern and affordable energy access for all; 8. Decent Work and Economic Growth, Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. 9. Industry, Innovation and Infrastructure, Build resilient infrastructures, promote inclusive and sustainable industrialization and foster innovation. 11. Sustainable Cities and Communities, Make cities and human settlements inclusive, safe, resilient and sustainable. 13. Action Against Global Climate Change, Take urgent measures to combat climate change and its impacts. 14. Life in the Water, Conserving and promoting the sustainable use of the oceans, seas and marine resources for sustainable development. 15. Terrestrial Life, Protect, recover and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, stop and reverse land degradation and stop loss. 17. Partnerships and Means of Implementation, Strengthen the means of implementation and revitalize the global partnership for sustainable development.