Orbital scale climate variability in East China Sea over last 400 ka: Implications and relevance

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INTRODUCTION:

Orbital parameters of Earth (viz. Eccentricity, Obliquity and Precession) determines the amount of solar radiation, which has direct influence on Earth's climate. The solar radiation is responsible for the differential heating of land and water-mass, which drives several climatic phenomenon like the Asian Monsoon System. In present study, we have assessed the variability in East Asian Summer Monsoon (EASM) and Kuroshio Current using planktic and benthic foraminiferal proxy and influence of orbital scale factors on climate variability in the East China Sea (ECS) over last 400 ka. Spectral analysis of climate sensitive planktic foraminiferal species like *Globigerinoides ruber*; oxic, suboxic, and dysoxic species of benthic foraminifera were carried out to know the orbital scale variability in the ECS. This study confirms the influence of orbital scale climate variability in EASM precipitation and Kuroshio current inflow.

OBJECTIVES: To find out EASM and Kuroshio Current variability in the ECS for last 400 ka and influence of Orbital scale factors on it.

Milankovitch Cycles:

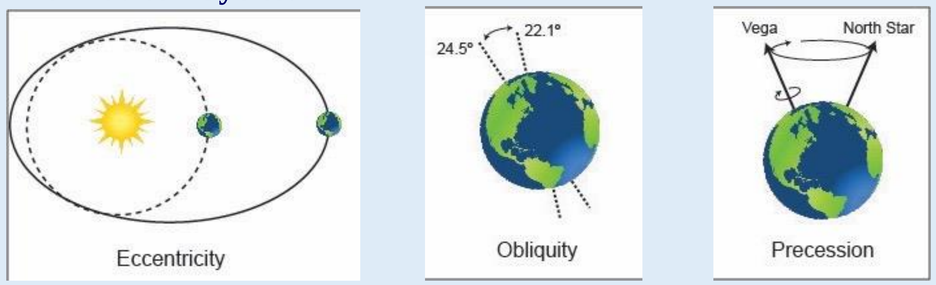

Fig. 1. Eccentricty of Earth's Orbit (~100 ka cyclicity), Obliquity of Earth's axis (~41 ka cyclicity) and Precession of Earth's axis (~20 ka-26 ka cyclicity).

STUDY AREA, MATERIALS AND METHODOLOGY:

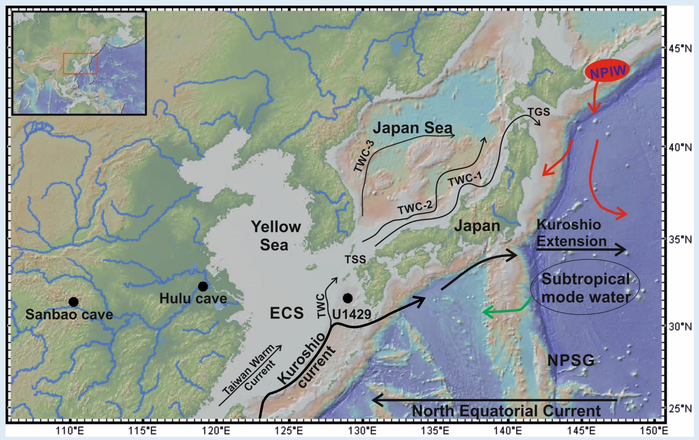

Fig. 2. Location map of Site U1429 in the ECS.

- IODP Site U1429 (31°37.04′N, 128°59.85′E), at 732 mbsl.
- Mainly influenced by precipitation runoff due to EASM and warm surface flowing Kuroshio Current.

- 196 sediment samples at ~1m interval for planktic foraminifera and 226 sediment samples for benthic foraminifera were used for present study, which date back to 396 ka.
- Samples were processed using standard methods outlined by Das et al., (2018) for generating planktic and benthic foraminiferal census data and percentage abundance was calculated.
- Spectral analysis was carried out using RED2CON MATLAB interface for executing REDFIT 3.8e program (Schulz and Mudelsee, 2002) for *G. ruber* (%), and oxic-suboxic-dysoxic benthic foraminiferal species (%).

RESULTS AND DISCUSSIONS:

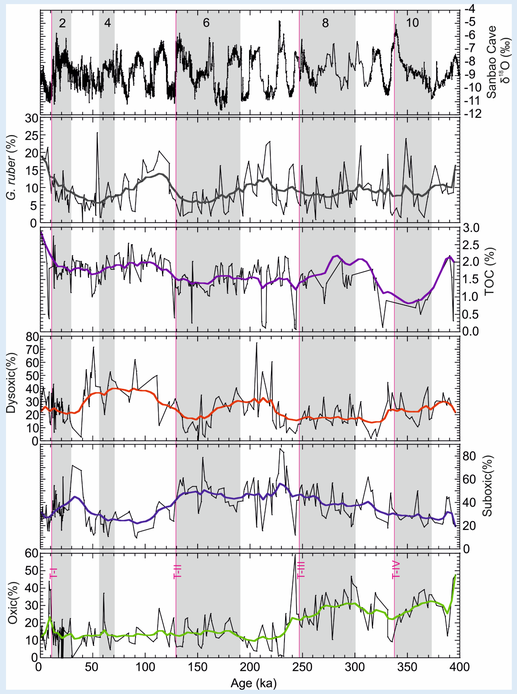

Fig. 3. Variation in Oxic-Suboxic-Dysoxic benthic foraminifera (%), Total Organic Carbon (TOC Wt. %) (Black et al., 2018), *G. ruber* (%) at site U1429 in ECS and Sanbao cave $\delta^{18}O$ (‰) (Cheng et al., 2016) for last 400 ka.

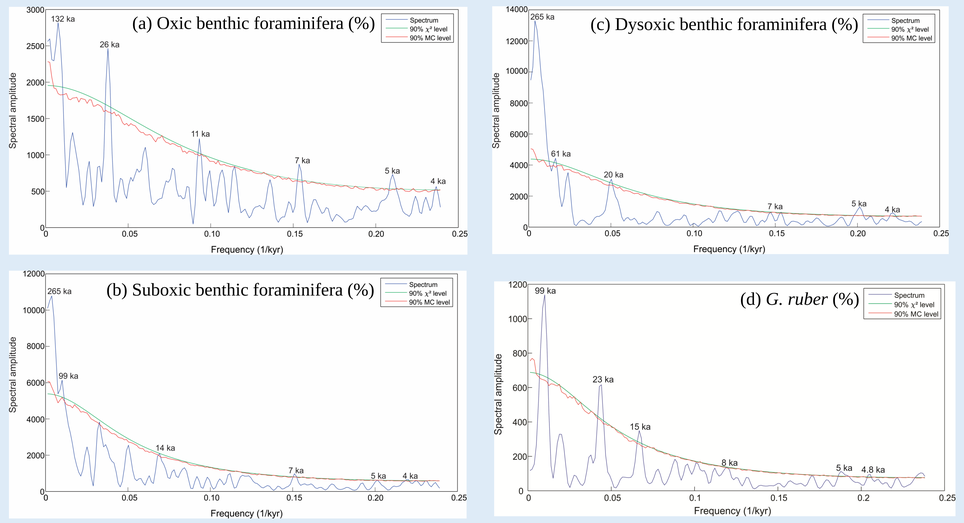

Fig. 4. Spectral analysis of (a) Oxic benthic foraminifera (%), (b) Suboxic benthic foraminifera (%), (c) Dysoxic benthic foraminifera (%), and (d) *G. ruber* (%).

- Kuroshio Current and EASM are the major factors that control the availability of dissolved nutrients as well as primary productivity at ECS.
- Higher primary productivity directly influences the dissolved oxygen content, which in turn affects the oxygen-sensitive benthic foraminifera.
- *G. ruber* (%) serves as indicator Kuroshio Current variability.
- Precession and Eccentricity scale variance is evident from spectral analysis of *G. ruber*, Oxic benthic foraminifera, Suboxic benthic foraminifera and Dysoxic benthic foraminifera.

CONCLUSIONS:

EASM and Kuroshio Current are major drivers of paleoceanographic change in East China Sea; and Spectral analysis of the proxy records reveals Eccentricity and Precession scale climate variability for last 400 ka in East China Sea.

ACKNOWLEDGEMENTS: ESSO-NCPOR, IODP and IIT Bhubaneswar are acknowledged for their support to carry this research. NV acknowledges CSIR for providing CSIR-SRF.

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