SOUTH JOULTER CAY, GREAT BAHAMA BANK - A GEO-ARCHIVE OF CLIMATE CHANGE AND SEA-LEVEL VARIATION?

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PROJECT OBJECTIVES

- Further calibrate the timing of key depositional events within the history of SJC with radiometric dating of select beach ridges.
- Thereby test to what extent island growth is the result of variations in storm frequency and/or sea level during the Holocene.

PROJECT RATIONALE

Our ongoing examination of South Joulter Cay (SJC), a key part of the modern Joulters ooid sand body on Great Bahama bank, targets a better delineation of the timing and processes that formed the island. High resolution imagery and a DEM constructed from a drone survey helped to formulate a scenario for island beach ridge development (Harris and Laya, 2022). We continue testing the hypothesis that the island ridges are the result of storm deposition and resulting changes to the local hydrodynamic setting (Fig. 1).

APPROACH

From observing the impacts of recent hurricanes, we believe that major storms delivering east to west energy and sediment transport are most likely to have played a role in island development,

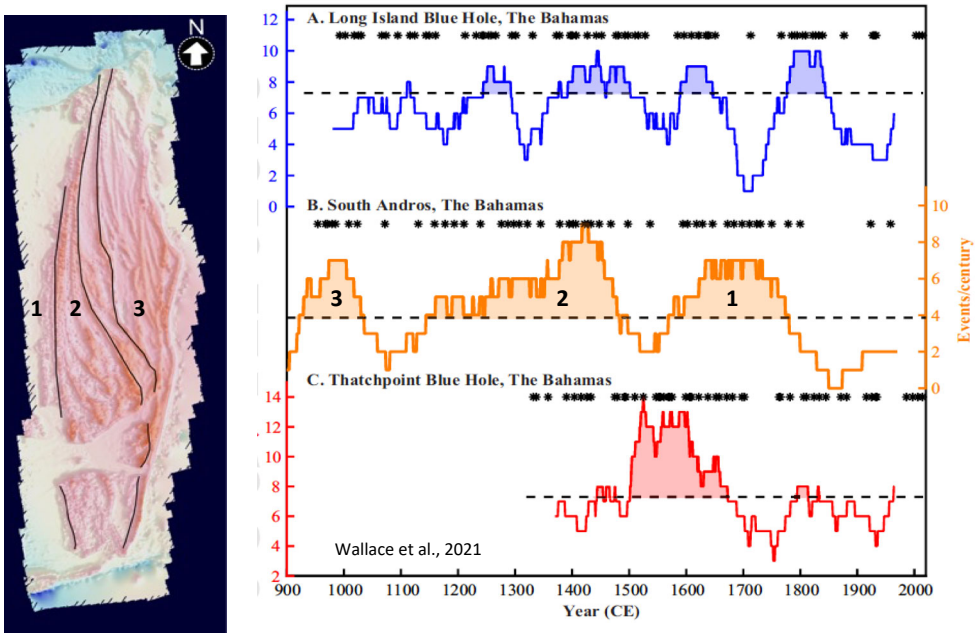

Figure 1: Left - DEM from high-resolution drone imagery (Harris and Laya, 2022) annotated to show interpreted morphological stages of island growth. Stage 1 Linear Ridges represent initial island formation; Stage 2 Arcuate Ridges formed as part of an ebb tidal delta lobe related to a channel cutting the island; and Stage 3 Cuspate Ridges were deposited as multiple prograding beach ridge sets driven by longshore currents. Right - Results from sediment coring by Wallace et al. (2019, 2021) in blue holes at three Bahamian sites to assess timing of storm deposits and therefore storm frequency. Data delineates periods of intense storm activity, numbered 1-3, that may relate to stages of island growth of SJC.

but that a single storm by itself may be insufficient to cause change (Laya and Harris, 2022). Instead, it is more likely that periods of intense storm activity as determined for the last 1100-1500 years by recent sediment coring and dating from several blue hole sites on GBB (Wallace et al., 2019, 2021) provide the type of collective storm activity that can relate to the initiation and growth change variability observed at SJC. We intend to calibrate the timing of key depositional events within the history of SJC with radiometric dating of select beach ridges to facilitate a more rigorous comparison with storm activity as well as possible sea-level change. Preliminary ^{14}C ages provided by the Keck Carbon Cycle AMS Facility of UC Irvine, which are still being evaluated, indicate ages 1775 YBP and younger. Note the timing of the oldest (1) period of intense storm activity on Figure 1.

SIGNIFICANCE

This study has relevance to facies interpretation and correlation within subsurface grainstone reservoirs. Islands like SJC add significantly to complexity and potential localized heterogeneity within a broader development of reservoir quality grainstone (Harris and Laya, 2022). Assessing the impact of storms in forming the island and changing ridge morphology will continue to help refine our understanding of the broad suite of controls over shallow carbonate platform facies patterns. And beach ridge systems like SJC are potentially important geo-archives for the study of climate change and sea-level variations over the Holocene.

REFERENCES

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