ANALYSIS OF DEEP-SEA CORAL MOUNDS ON THE NORTH-CENTRAL BLAKE PLATEAU, SOUTHEAST U.S. CONTINENTAL MARGIN

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#4332

BACKGROUND

Since 2018, the NOAA Office of Ocean Exploration and Research has utilized the NOAA Ship *Okeanos Explorer* to map a region along the southeastern United States continental margin known as the Blake Plateau, an extensive, relatively flat feature formed during the Atlantic Ocean's formation (Dillon et al., 1988). Extending more than 250 km off the apex of the South Atlantic Bight, with depths ranging from 500 to 1000 m, the Blake Plateau is becoming recognized as hosting critical habitats for deep-sea coral, sponges, and other biologically important species. Coral ecosystems are home to a diverse set of species and, as they are highly sensitive to their environments, are also valuable for understanding paleoclimate records (Roberts et al., 2006). In 2019 NOAA Ocean Exploration launched the expedition *Windows to the Deep 2019: Exploration of the Deep-sea Habitats of the Southeastern United States (*EX1903L2) with the goal of gaining baseline information about unknown and poorly understood deep-water areas (NOAA, 2019). During this and other expeditions in the region, numerous deep-sea coral mounds were mapped and explored. Coral mounds analyzed have been classified as **Individual Mounds** or **Connected Mounds** (Horn & Sautter, 2021). Individual Mounds are further divided into **Single-Peak** or **Multi-Peak Individual Mounds**, based on their shape index, profiles, and vertical relief (Berkimer & Sautter, 2020). The purpose of this study is to use multibeam sonar data collected to examine the geomorphology of coral mounds of the North-Central Blake Plateau (Fig. 1), and to characterize and classify relationships between formations of individual and connected mounds.

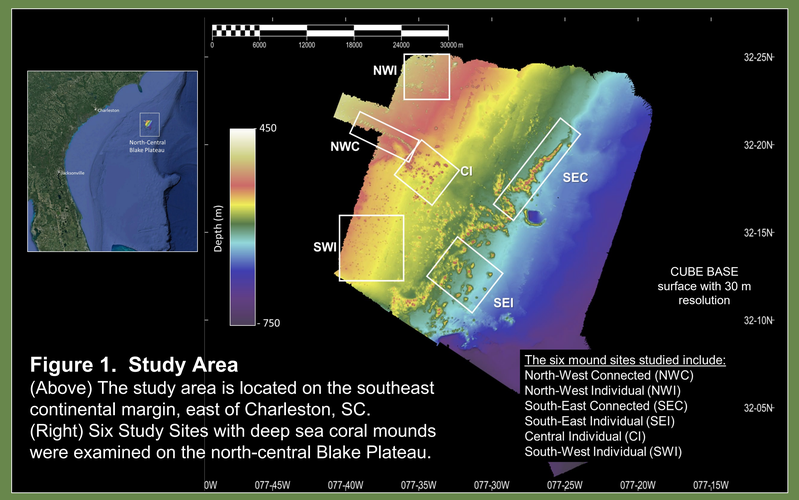
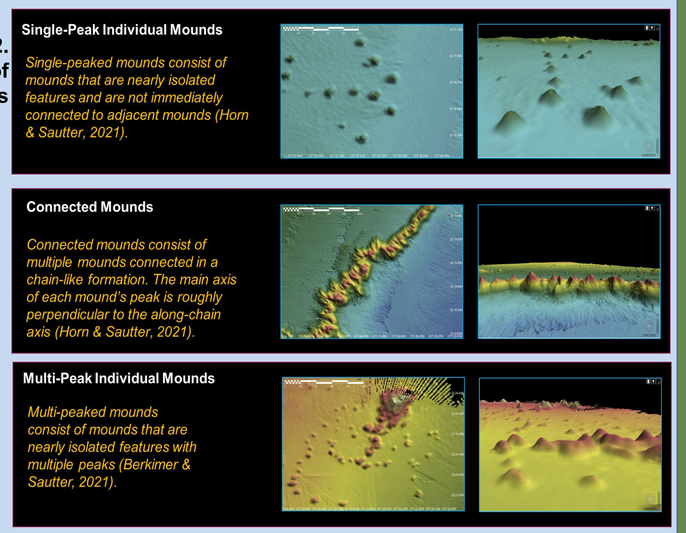


Figure 1. Study Area
(Above) The study area is located on the southeast continental margin, east of Charleston, SC.
(Right) Six Study Sites with deep sea coral mounds were examined on the north-central Blake Plateau.

Figure 2. Comparison of Geomorphologies

Three mound geomorphologies were found on the North-Central portion of the Blake Plateau. These features can be best described and defined by comparing and analyzing their profiles.



NOAA Ship *Okeanos Explorer*

METHODS

- This study used raw multibeam sonar data from surveys conducted during expeditions EX1903L2, EX1907, EX1805 and EX1806, collected from May 2018 through July 2019.
- The NOAA Ship *Okeanos Explorer* served as sonar platform, carrying a Kongsberg EM302.
- Bathymetric and slope surfaces were made using CARIS HIPS and SIPS 11.3, with variable, 30 and 15 m resolutions.
- Coral mound sites were selected based on mound connectedness or individuality, with slopes 20- 45°.
- Profiles of individual mounds were analyzed to determine a shape index and vertical relief.
- Shape index was calculated as Length/Width, where higher values indicated increasing mound elongation.
- Vertical Relief was calculated at Base(m)- Shoal(m).

Figure 3. Single-Peaked and Multi-Peaked Individual Mound Sites
Four Individual Mound sites were examined, with 3 having both single-peaked and multi-peaked individual mounds. (Depth scales vary per site. All sites have a resolution of 15 m. Scale bars are 5000 m. All 3D images VE=3.0x).

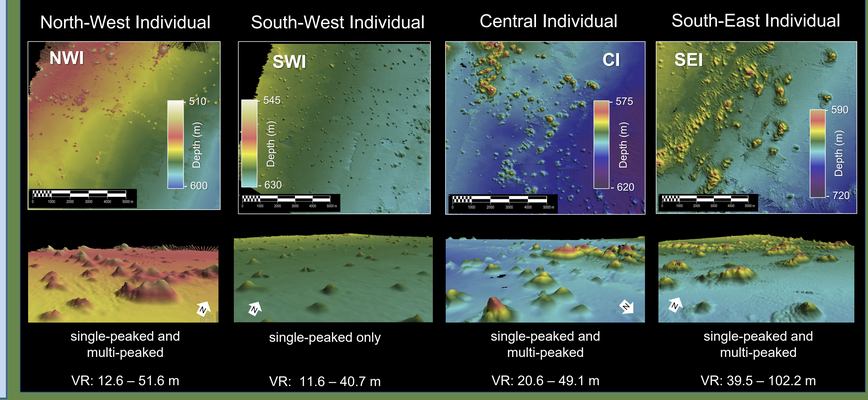


Figure 4. Individual Mound Comparisons
Single-peaked individual mounds have a VR range of 20 to 125 m and a base length range of 200 to 650 m. SEI mounds are the largest.
Multi-peaked individual mounds have similar vertical reliefs and lengths. There are several points on the profile where the mound dips and rises again creating multiple peaks. SWI had no multi-peaked mounds.

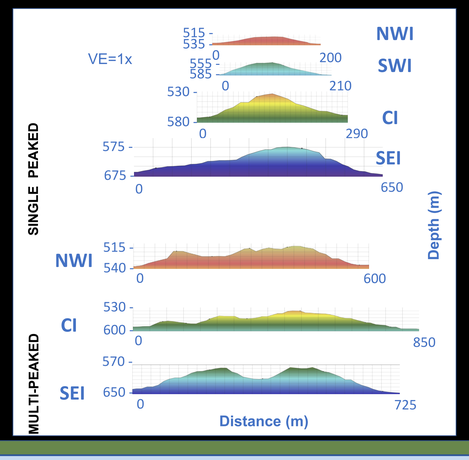


Figure 5. Connected Mound Sites
Two sites with linear Connected Mounds were examined. (Depth scales differ per site. Both sites have a resolution of 15 m. Scale bars are 5000 m. All 3D images VE=3.0x).
(Below) Connected mounds were analyzed using profiles made perpendicular to the chain. A difference in depth was found on each side of the chain between 6- 25.1 m (NWC) and 27- 34 m (SEC). These depth difference confirm there is a definite step or slight terrace that the coral is growing along.

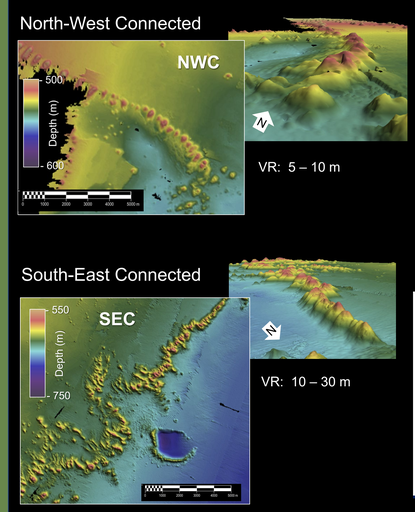
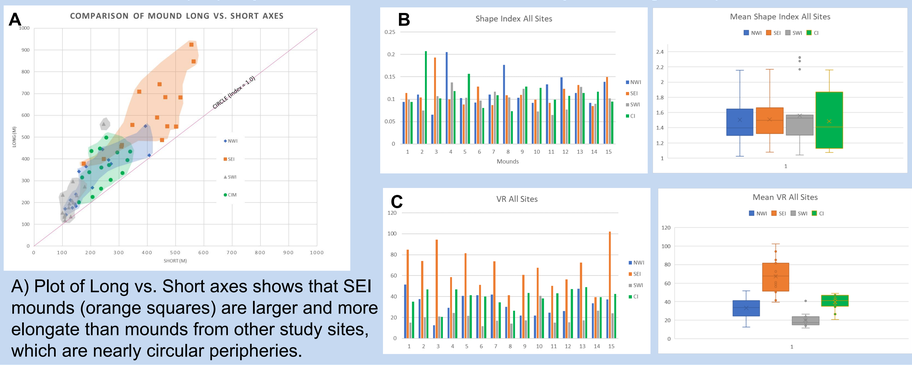


Figure 6. Mound Shape Index and Vertical Relief

Length and width were measured for 15 mounds at each Individual Mound site and data were used to generate a **Shape Index,** where an SI = 1.0 has a circular periphery. **Vertical Relief** was also calculated by measuring the depth differences between shoal and base.



A) Plot of Long vs. Short axes shows that SEI mounds (orange squares) are larger and more elongate than mounds from other study sites, which are nearly circular peripheries.

B) Although SEI have a different size range (see A), no significant variability in the Shape Index was found among the four sites.

C) SEI (orange) has a significantly higher VR than all other sites, but especially SWI. SWI mounds (gray) are significantly shorter than those at other sites. NWI (blue) and CI (green) have similar vertical relief.

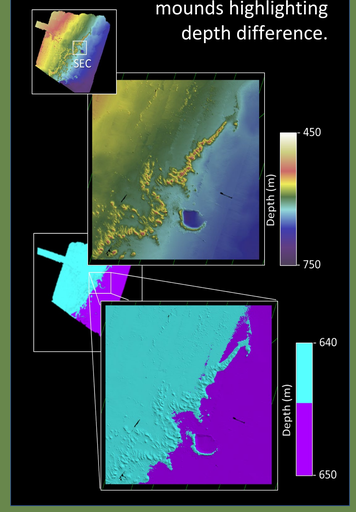
DISCUSSION and CONCLUSIONS

Individual Mound Sites: Four individual mound study sites had relatively similar geomorphology. All the sites were comprised of either multi-peaked or single-peaked individual mounds and had an underlying substrate of <1°. The **North-West Individual**, **South-East Individual** and **Central Individual** sites were comprised of a mix of both multi-peaked and single-peaked mounds. All three of these sites were at the base or close to a chain of connected mounds. **South-West Individual** was the only site with exclusively single-peaked mounds. These mounds were not situated close to any connected or multi-peaked individual mounds. South-West Individual mounds had a vertical relief (VR) range of 10 to 25 m. In contrast, the other three individual sites had VRs ranging from 13 to 102 m. While all four sites had similar shape, **SEI** mounds were larger, generally more elongated, and significantly taller. Although individual mounds were varied in geomorphology, in general, the more elongate mounds (SEI) were higher in relief. Multi-peaked mound formation was found at sites closer to connected mound sites.

Connected Mound Sites: Connected mound formation appears to follow edges of terraces where slight but distinct changes in depth occur, likely due to an upper rock layer termination. Changing the **South-East Connected** site color scale (aqua <640 m and purple >650 m) (Figure 7) allows for an easier visualization of the coral mounds having formed along this terrace step. Connected mounds at the **North-West Connected** site were also found situated along a small terrace scarp. Corals likely form along terrace edges due to underwater currents hitting the edge of the rock outcrop and upwelling, providing the food necessary for coral to grow.

Connected chains of deep-sea coral mounds on the North-Central portion of the Blake Plateau appear to form as a result of the underlying geologic controls.

Figure 7. Edited color scale of SEC mounds highlighting depth difference.



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