



Multibeam Sonar Analysis of the South Carolina Shelf-Edge

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- Methods:**
- Multibeam sonar collected aboard NOAA ship Nancy Foster
 - Bathymetric maps of multibeam data created using CARIS HIPS 6.1
 - Video and Johnson *Sea Link* submersible video were collected from previous cruises in same general area
 - Sediment data from previous Transect cruises on SC shelf edge were also analyzed

Multibeam sonar data were collected on a cruise led by Dr. George Sedberry aboard the NOAA ship Nancy Foster from June 26-July 4 in 2007. Data were then processed using CARIS HIPS 6.1 bathymetry software. The area mapped sits on the rocky continental shelf edge off the coast of South Carolina with depths ranging from 40 to 80 m. Processed bathymetric images were compared to underwater video taken with the Johnson *Sea Link* submersible in the same general area, to characterize and compare the geological features of the shelf edge. The South Carolina shelf edge is being studied to characterize areas of unique biodiversity that would be most advantageous for the development of new conservatory management.

Multibeam data are used to analyze sea floor features and the ROV unit captures ground-truth video.

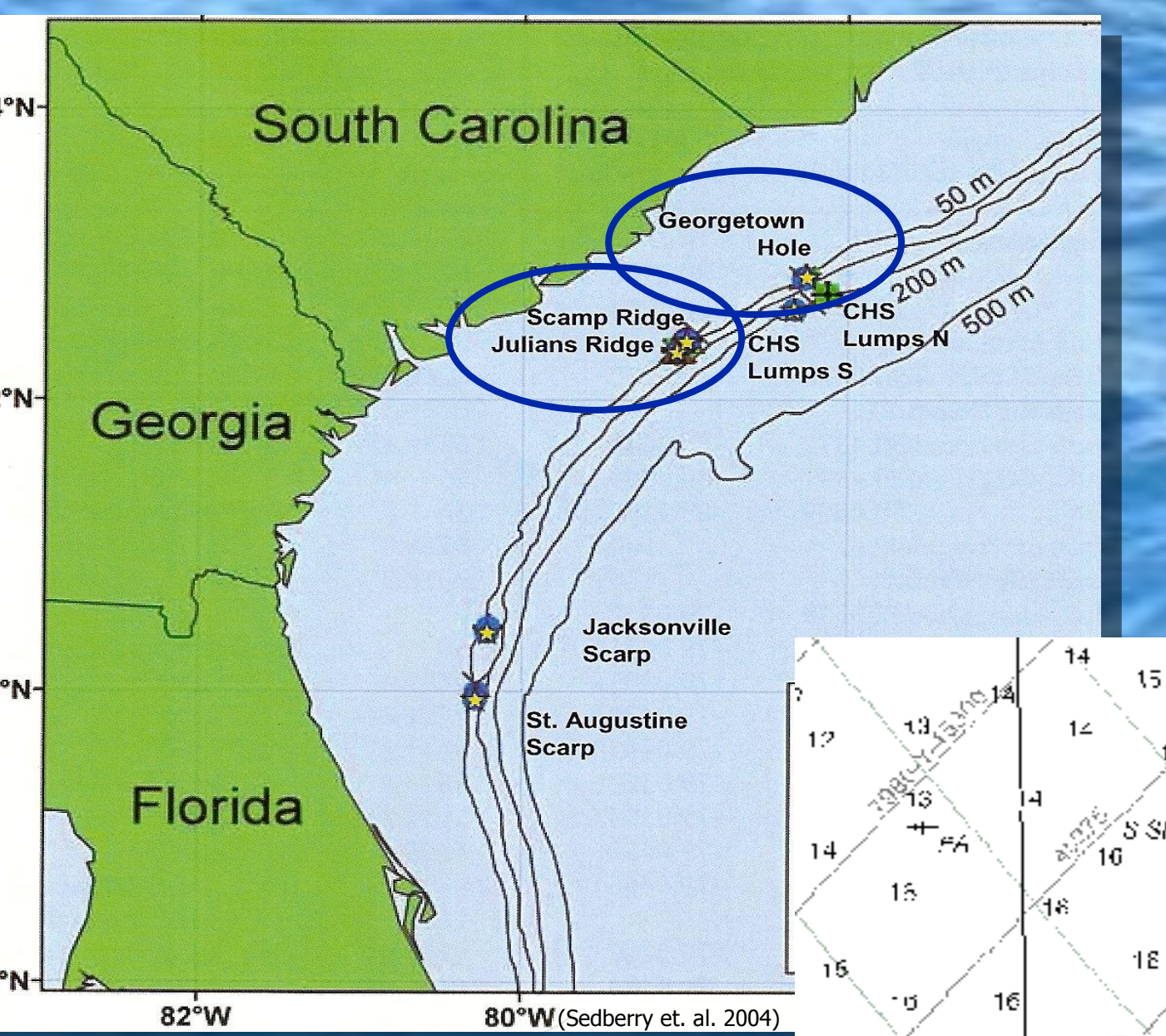
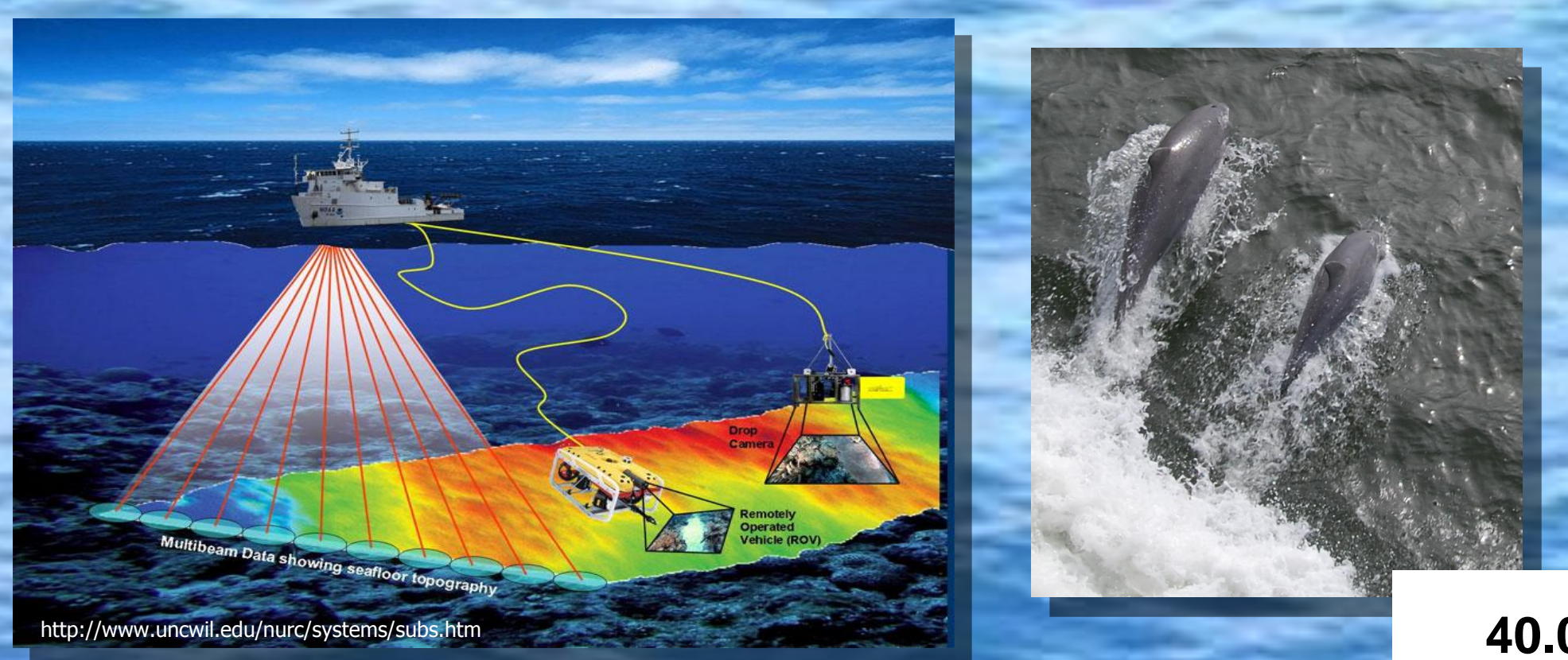


Fig. 1. Map highlighting the three sections of data: Georgetown Hole, Scamp Ridge, and Julian's Ridge. Each section is highlighted in Figure 3.

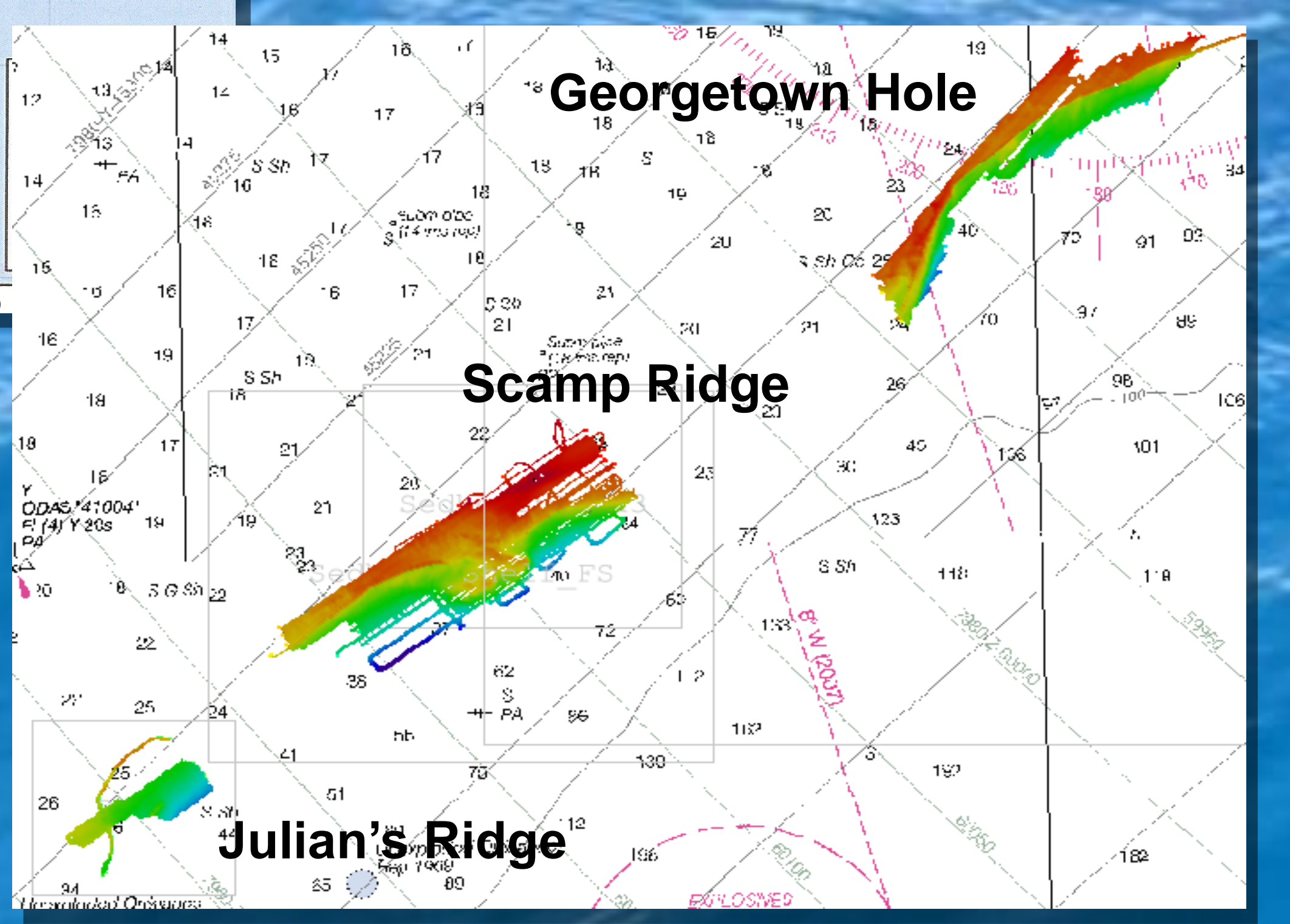


Fig. 2. Video screen grabs from Johnson *Sea Link* submersible dives, collected during the summer of 2002, from Julian's Ridge to Georgetown Hole. Julian's Ridge and Scamp Ridge have similar seafloor composed of boulder-sized rocks randomly dispersed. Georgetown Hole has smaller rocks that are less jagged and more sand between the rocks.

Julian's Ridge

09-01-02 10:49:16
 Depth 181.8 Temp 20.99 Salin 36.62

Scamp Ridge

09-02-02 10:52:01
 Depth 165.0 Temp 22.05 Salin 36.64

Georgetown Hole

09-04-02 17:48:12
 Depth 168.8 Temp 20.84 Salin 36.49

A

09-01-02 10:49:16
 Depth 181.8 Temp 20.94 Salin 36.68

Close-up bathymetry of section of Scamp Ridge showing broken rocky surfaces surrounded by sediment plain

B

Typical shelf-edge rocky bottom with marine life on the surface.

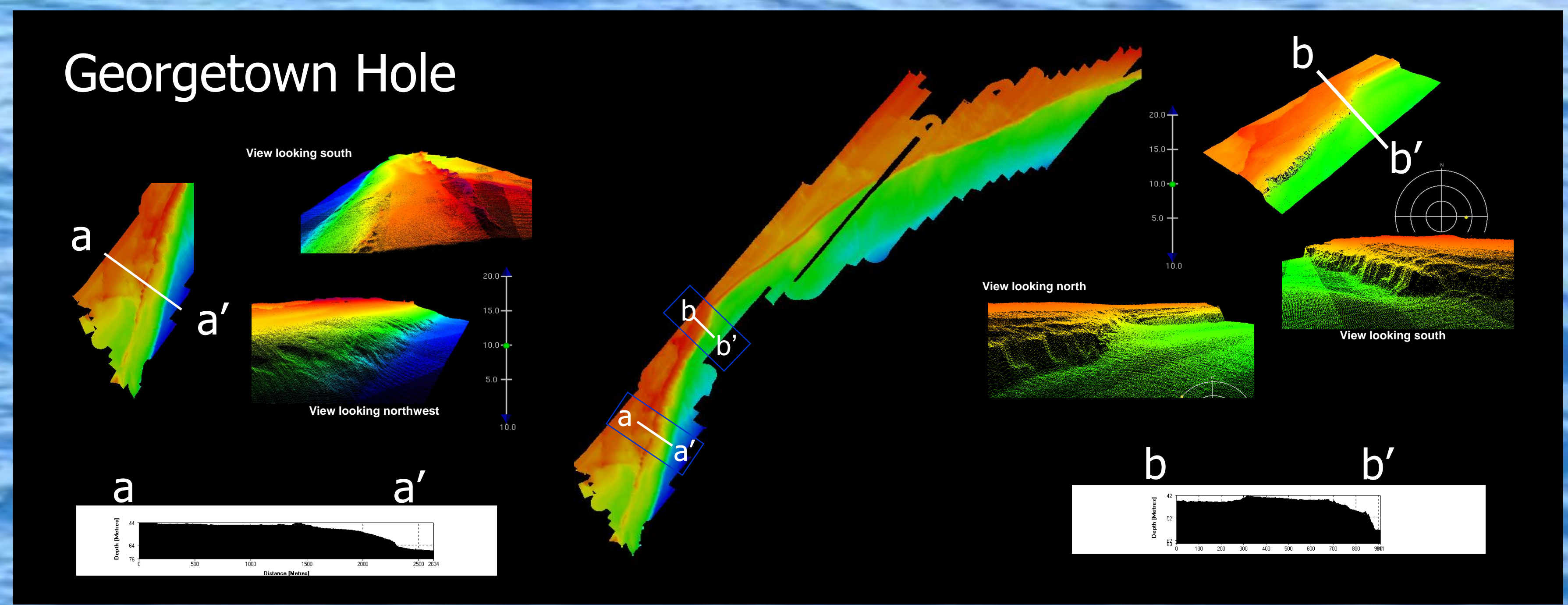
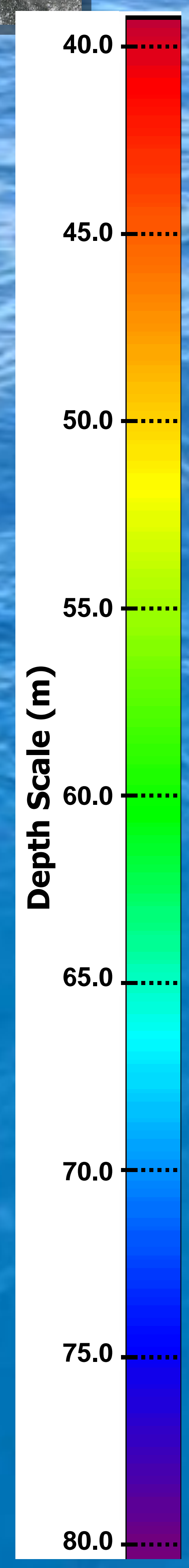


Fig. 3A. Georgetown Hole. This section of the shelf edge shows two unique features. The area at profile a-a' shows a feature similar to a point or headland and pinches out with a ridge-like feature. The relief is about 30 meters. Profile b-b' is located along the shelf-edge where near-vertical relief is found. A slump-like feature is adjacent to this portion of the Georgetown Hole area. This could indicate failure of the shelf-edge rock layers and sediments.

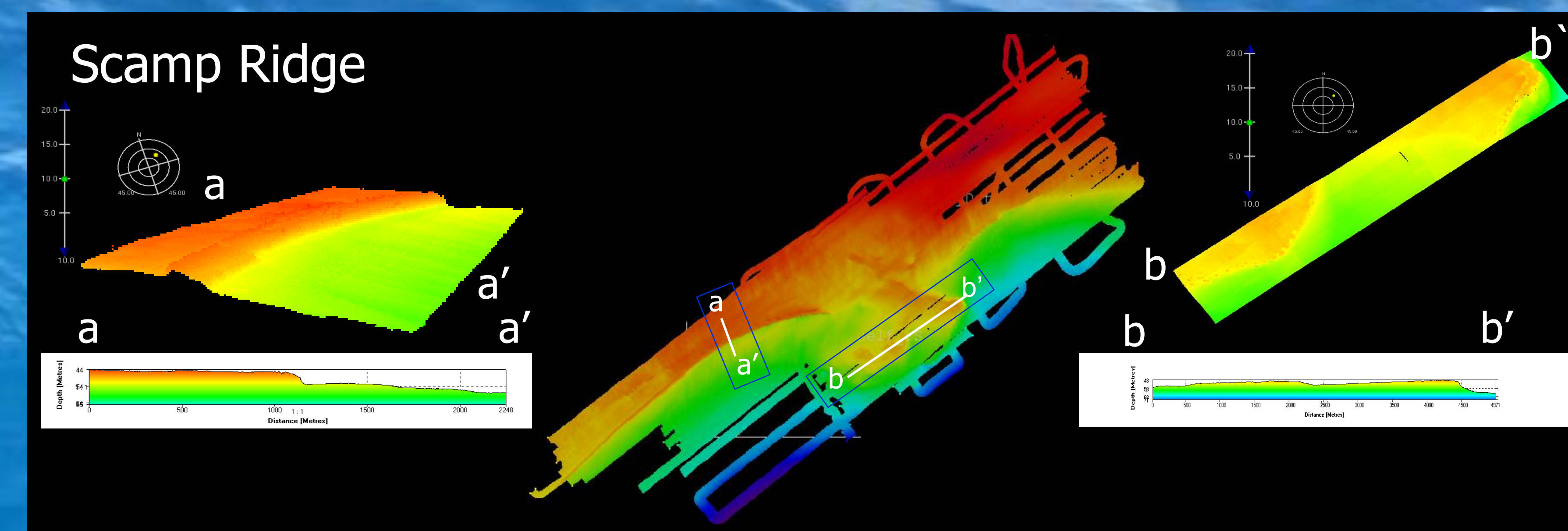


Fig. 3B. Scamp Ridge. This section of the shelf-edge shows a smooth, curved scarp with an interesting feature – similar to a headland - in the central portion. Profile a-a' magnifies the scarp and shows the relief to be ~10 m. The 'headland' feature is highlighted in profile b-b', and appears to be deposits of a mass wasting event from the 10 m scarp.

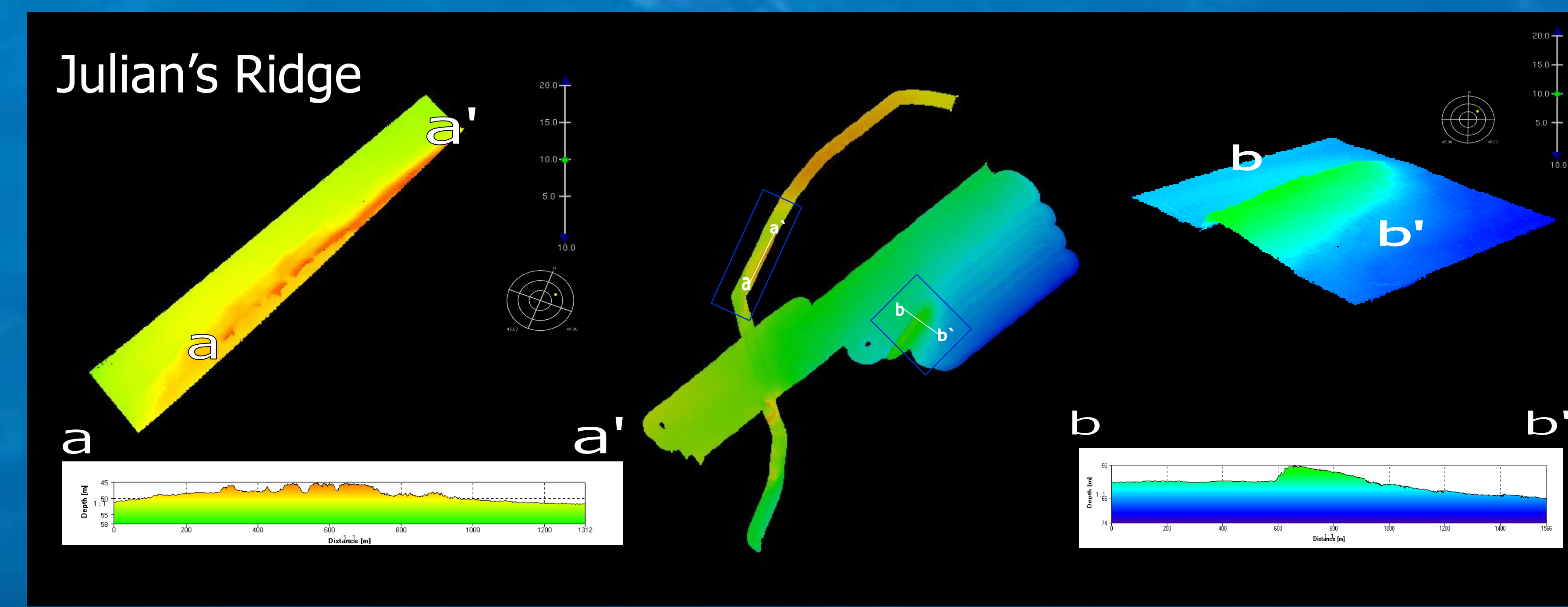


Fig. 3C. Julian's Ridge. This section of the shelf-edge has a gentle relief with two features highlighted. The area at a-a' is a linear feature which appears to be a ledge. The profile for a-a' shows the uneven seafloor with several outcroppings. B-b' shows a large body of sediment separated from the sediment at the same depth. The profile b-b' illustrates the change in depth at this feature compared to the surrounding seafloor.

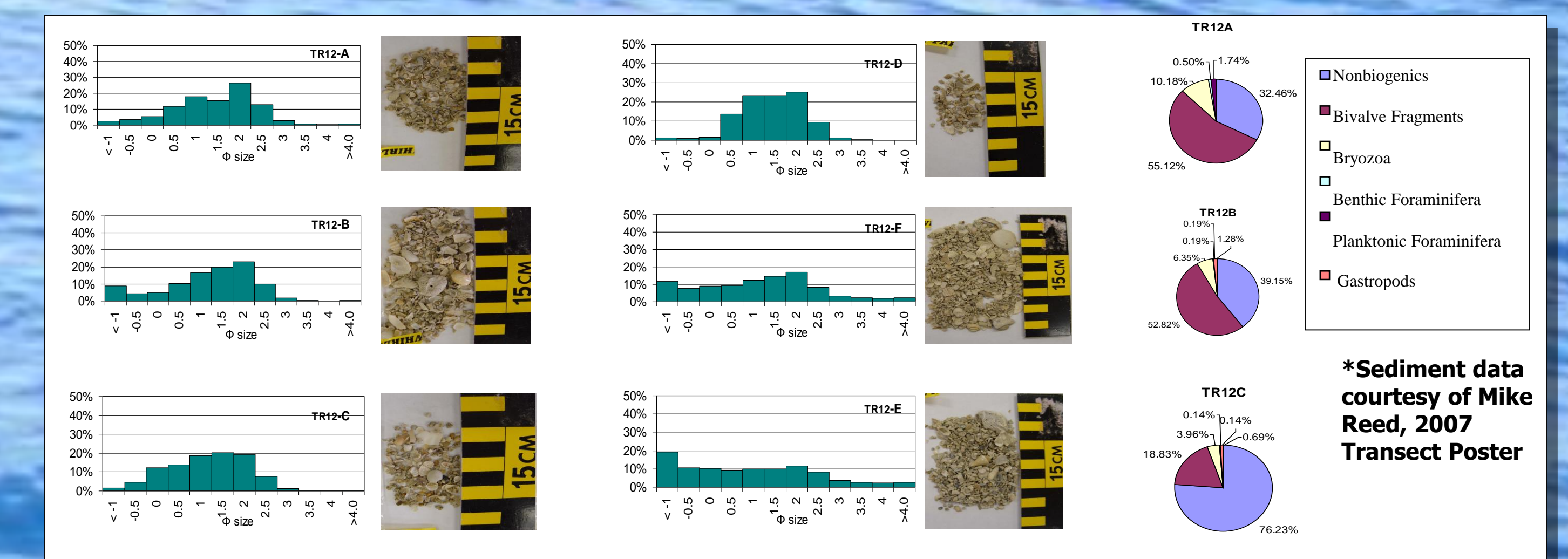


Fig. 4. These samples were taken from the Crescent Ridge area of Doc's Rocks, located west of our study. A phi-value (Φ) is a measure of grain size. A negative phi-value indicates that the grains are very coarse, and a positive phi value indicates that the grains are very small. Sample TR12-C is different from the others in composition because it contains a large amount of non-biogenics, due to its location on a flat area of Crescent Ridge. A flat, featureless area is not a preferred habitat for fish or reef builders since it is unprotected. In sample TR12-E, the majority of sediments have a phi value of -1. This sample was collected on a steep drop-off and the majority of sediments are most likely coarse rock fragments that fall off the ridge due to their density. (Reed, 2007).

- Results:**
- Multibeam data analysis shows characteristic ridges along the shelf-edge, with a large mound of sand displaced by a slump (Fig. 3).
 - Sea Link* Submersible video shows rocky substrate with spotty sedimentation and moderate coverage of benthic fauna (Fig. 2).. Video also included numerous reef fish sightings and sessile invertebrates (Fig. 2).
 - Lithogenic and biogenic sediment samples collected to the west of the study area illustrate characteristic rocky bottom reef soft substrate (Fig. 4).

Discussion:

The expedition, led by Dr. George Sedberry (formerly of the SC DNR) mapped the area off SC from Georgetown Hole to Julian's Ridge. The goal was to find underwater geological features that correlated with areas where fish like to spawn, and use these features as indicators of significant deep reef habitats that could potentially be protected to increase the population of overfished species.

By using multibeam analysis to create bathymetric images of the sea floor, underwater features can be observed, then compared to video recordings, sediment data, submersible dives and any other informative data collected at the same location to characterize the deep sea habitat and identify the biota living in the area. Largescale sea bottom features, such as ridges and bumps, have an affect on environmental factors such as seawater circulation and plankton productivity that contribute to the survival of fish.

After observing underwater video collected at Scamp and Julian's Ridges, it was confirmed that the sea bottom was dominated by deep sedimentation around rocky outcrops and scattered boulders with a densely diverse biomass consisting of large invertebrates (wire corals, bryozoans) and reef fish (snapper, grouper, gag, greater amberjack) (Fig. 2). Abundant epifauna which are anchored to the rocky substrate attract the reef fish, making the area a desired spawning site for the fish to return to each year. Proof of spawning was not documented by the expedition directly, but courtship behavior was observed in hogfish and scamp at Julian's ridge and a school of red snapper was spotted at Scamp Ridge indicating a possible spawning aggregation (Fig. 2). Sedberry et al. determined through multiple data analysis of Georgetown Hole show that there is a decrease in faunal diversity, and smaller invertebrates (tunicates, sponges) tend to dominate the rocky outcrops as compared to Julian's Ridge. As for spawning indicators at Georgetown Hole, gray triggerfish were spotted near depressions containing egg masses, suggesting the area as a possible spawning site.

If similar features corresponding to these deep reef habitats can be identified using bathymetric images, more areas can be examined for potential protection through organizations like the South Atlantic Fishery Management Council, and populations of overfished species may no longer decline as they have been in the past, but may instead start to see a positive increase.



Reference: Sedberry, G., Cooksey, C.L., Crowe, S.E., Hyland, J., Jutte, P.C., Ralph, C.M., and Sautter, L.R. Characterization of Deep Reef Habitat off the Southeastern U.S., with Particular Emphasis on Discovery, Exploration and Description of Reef Fish Spawning sites. May 2004., project # NA16RP2697

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