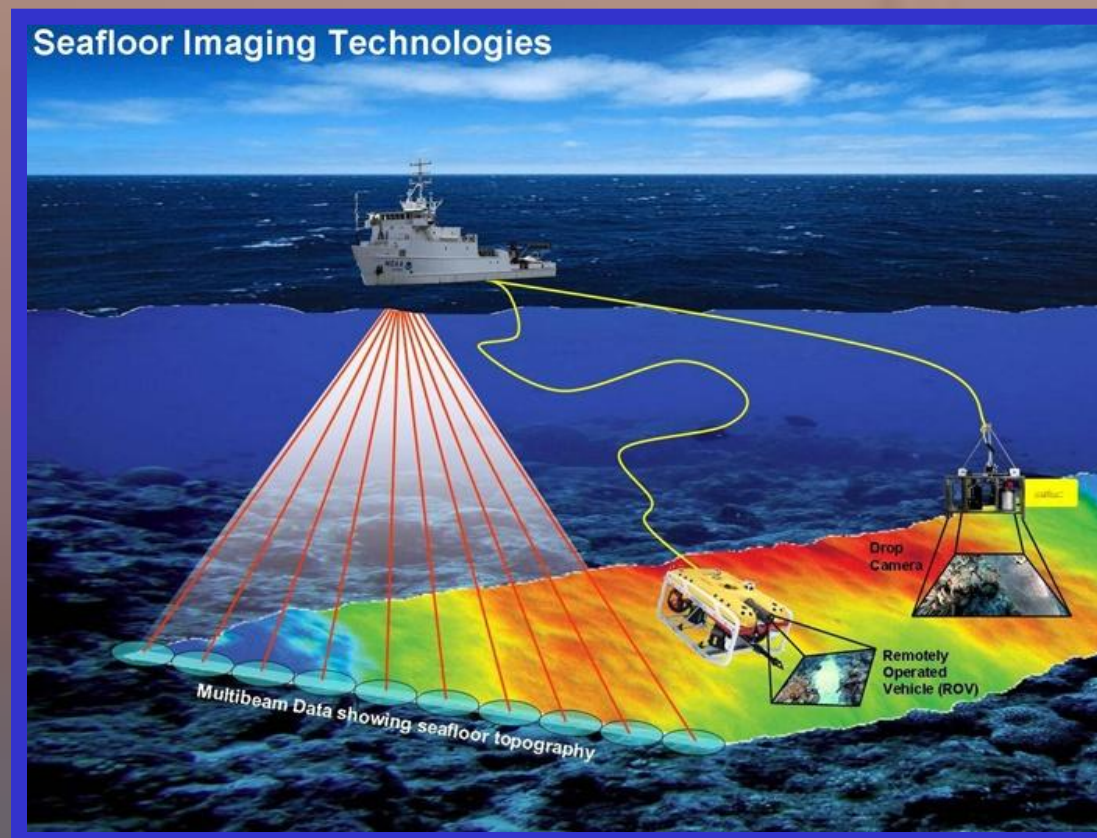
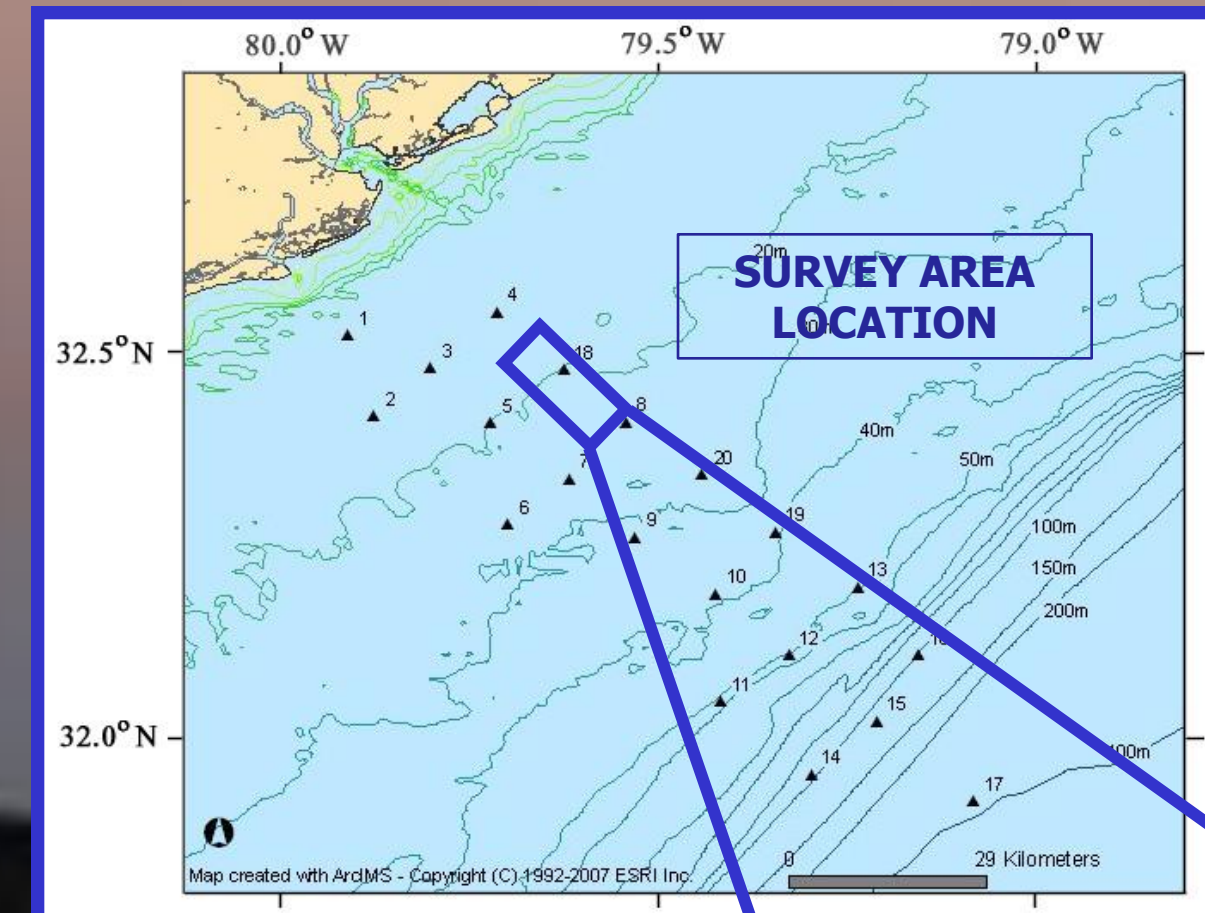


MULTIBEAM SONAR ANALYSIS OF PALEO-COASTLINE FEATURES OFF OF CHARLESTON, SOUTH CAROLINA

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NOAA Ship NANCY FOSTER



METHODS

- Raw multibeam sonar data were acquired using Simrad EM1002 aboard the NOAA Ship *Nancy Foster*.
- Data were cleaned and processed using mapping software CARIS HIPS 6.1.
- New multibeam data, coupled with previous sediment studies (Danese et al., 2007) from the survey area, were analyzed to determine possible origins of the submarine features.

Multibeam sonar data collected, Nov. 9- 11, 2006 aboard the NOAA Ship *Nancy Foster* reveal several interesting bathymetric features. The survey site is located 30 km off the coast of Charleston, South Carolina at water depths between 20-25 m. Sonar data were analyzed using Caris HIPS 6.1 software and show a meandering paleo-river channel, now referred to as the Transect Meanders, first discovered by undergraduate students in the 2004 College of Charleston Transect Program. The submerged meandering channel extends over 4 km in a NW-SE trend perpendicular to the shoreline with water depths ranging from 19 to 25 m. The depths and widths of the channels vary throughout the section: northwestern portions are 10 m deep and 18-22 m wide, whereas the southeast channel features are 12-24 m deep and 29-31 m wide. In addition to this paleo-channel, a series of linear features, with lengths as great as 500 m, were discovered in the southeastern region of the survey area which lay adjacent to a massive sand body in the SE. Overall, this area could be interpreted as features formed along an ancient coastline when sea level was approximately 20 m lower than present. It is possible that the shore-line features formed from a paleo-sea level that existed during the Younger Dryas period of 11,000 ybp. The goals of this study are to utilize these bathymetric features to identify distinct regions within the survey area based on geomorphologic characteristics, as well as to determine areas that should be revisited.

BACKGROUND

- Multibeam sonar mapping of the survey area performed during the 2006 research cruise onboard the NOAA Ship *Nancy Foster* revealed several distinct bathymetric features:
 - a submarine meandering channel trending NW-SE along the entire survey region (the Transect Meanders), with varying sedimentology (Danese et al., 2007)
 - a series of linear features found in the southeastern portion of the survey area
 - a massive sand body in the far southeastern section of the survey area, composed primarily of poorly sorted medium to coarse-grained sand (Danese et al., 2007)
 - deeper regions which are composed mostly of bivalve fragments (Danese et al., 2007).
- During previous studies it was suggested that the survey area marks the paleo-coastline off of South Carolina during the last sea level low stand approximately 11,000 ybp (the Younger Dryas Period) (Stubbs et al., 2007).
- Sediment samples from the Transect Meanders, the massive sand body, and the deeper areas of the survey site were analyzed in order to further characterize previous and current geological and biological characteristics of the region (Danese et al., 2007).
- The survey area was further analyzed by video data collected from ROV and SCUBA dives (Stubbs et al., 2007).

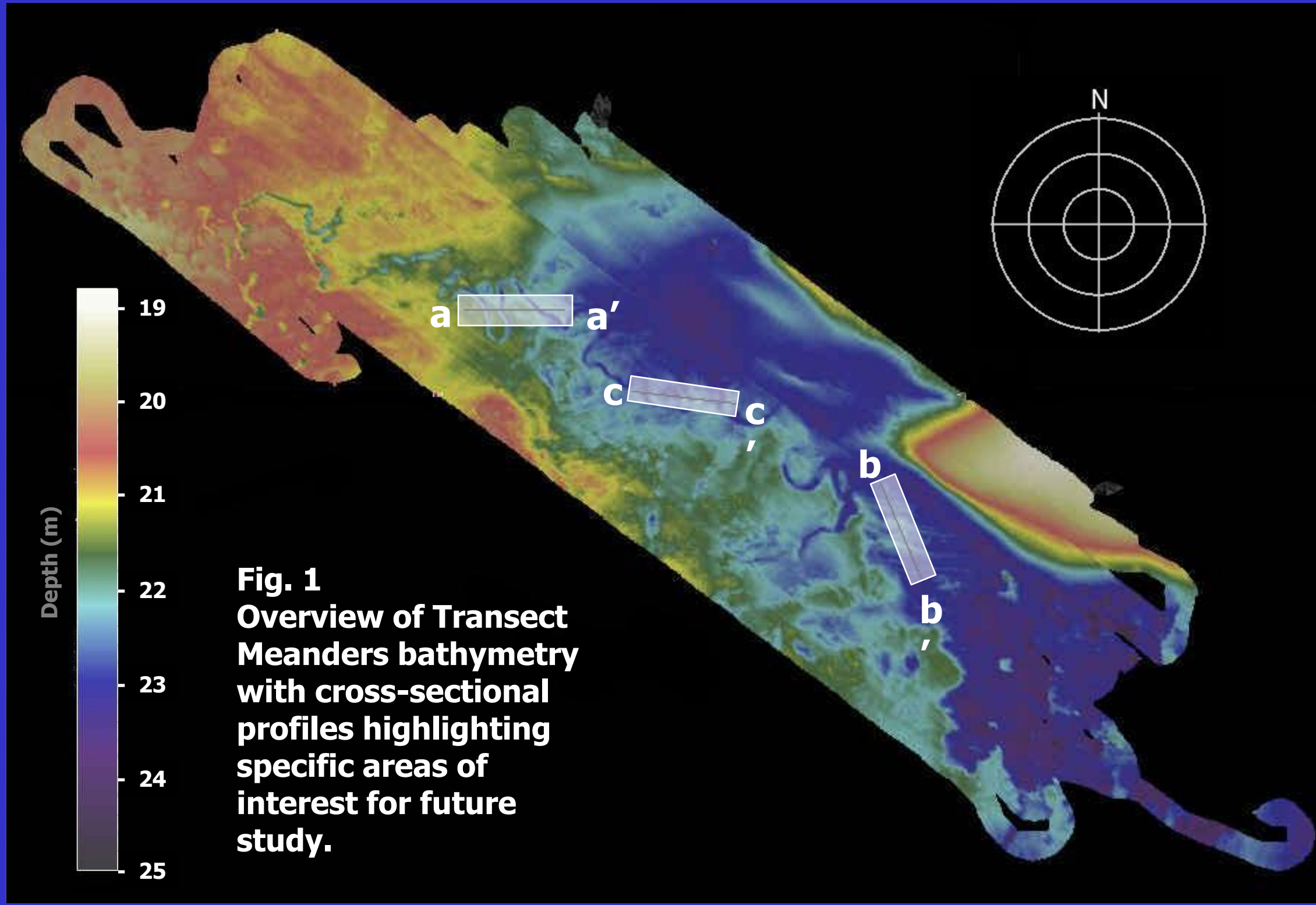
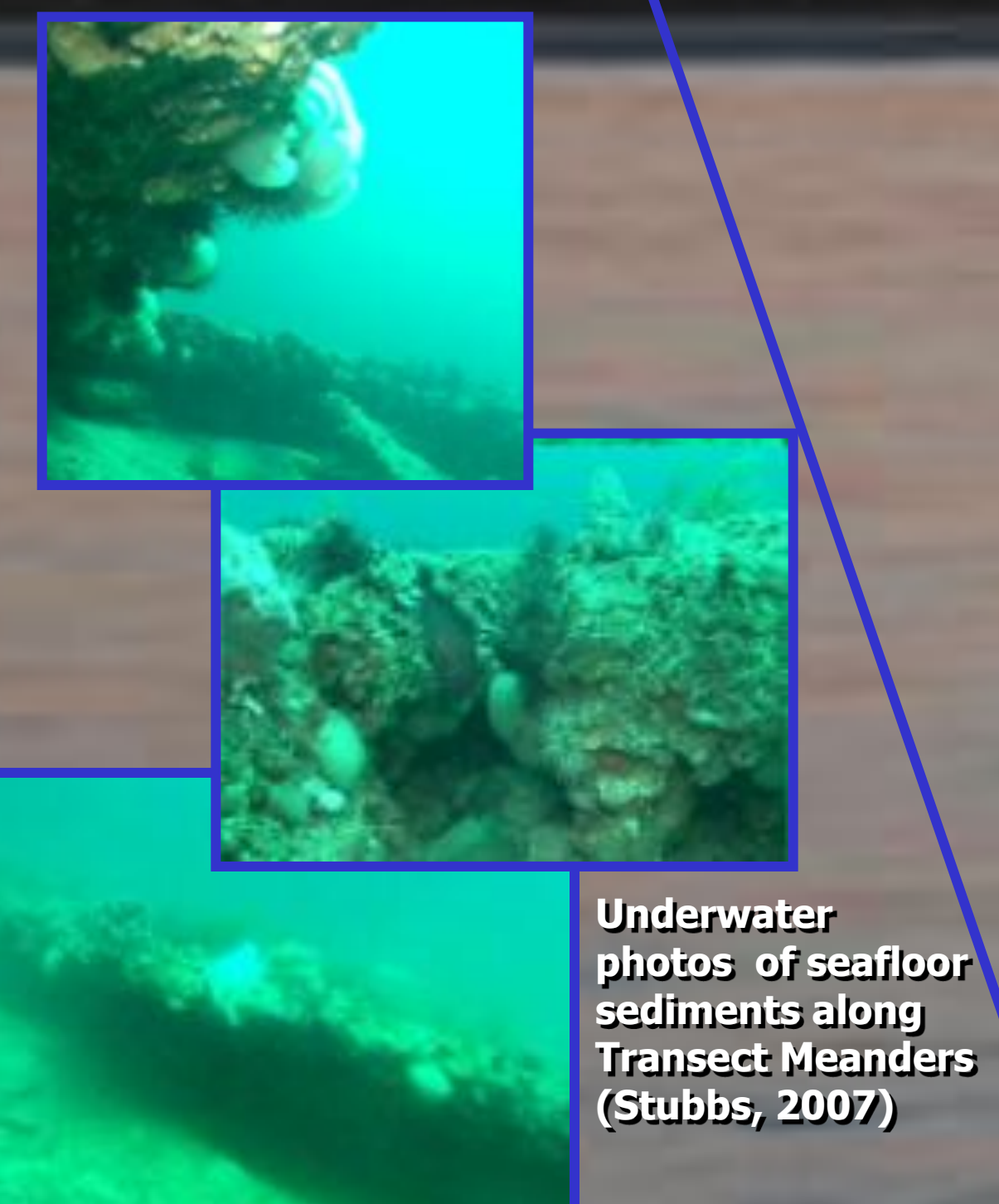


Fig. 1 Overview of Transect Meanders bathymetry with cross-sectional profiles highlighting specific areas of interest for future study.

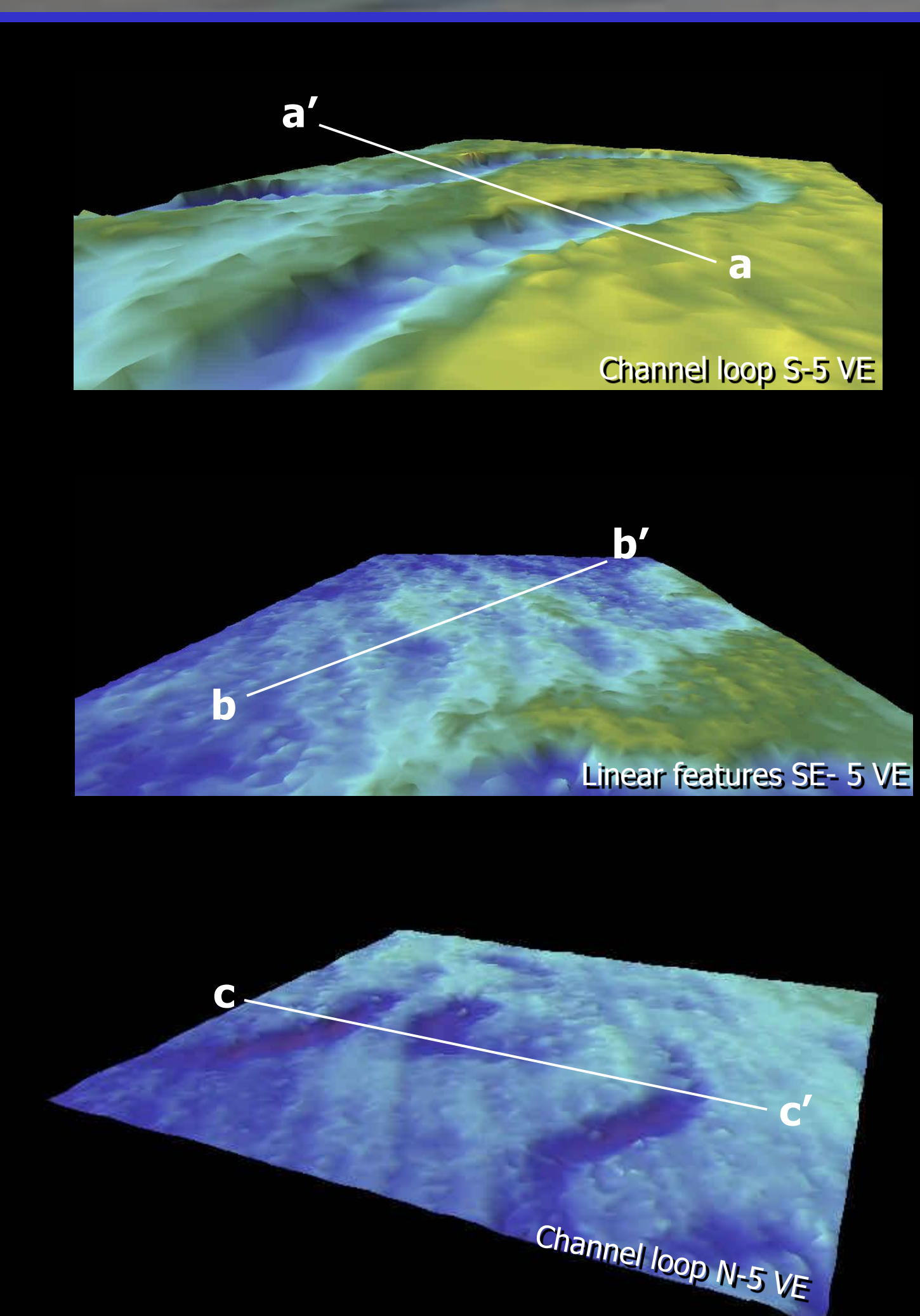


Figure 3. Three cross-sectional profiles depicting notable features of interest within the Transect Meanders. Locations are shown on the basemap (Fig. 1). Figures 3a and 3c are both meandering channels running throughout geomorphologically distinct. Region A Figure 3b is unique in that, it depicts the distinguishing unknown linear features of Region B which run adjacent to the large sand body found in Region C.

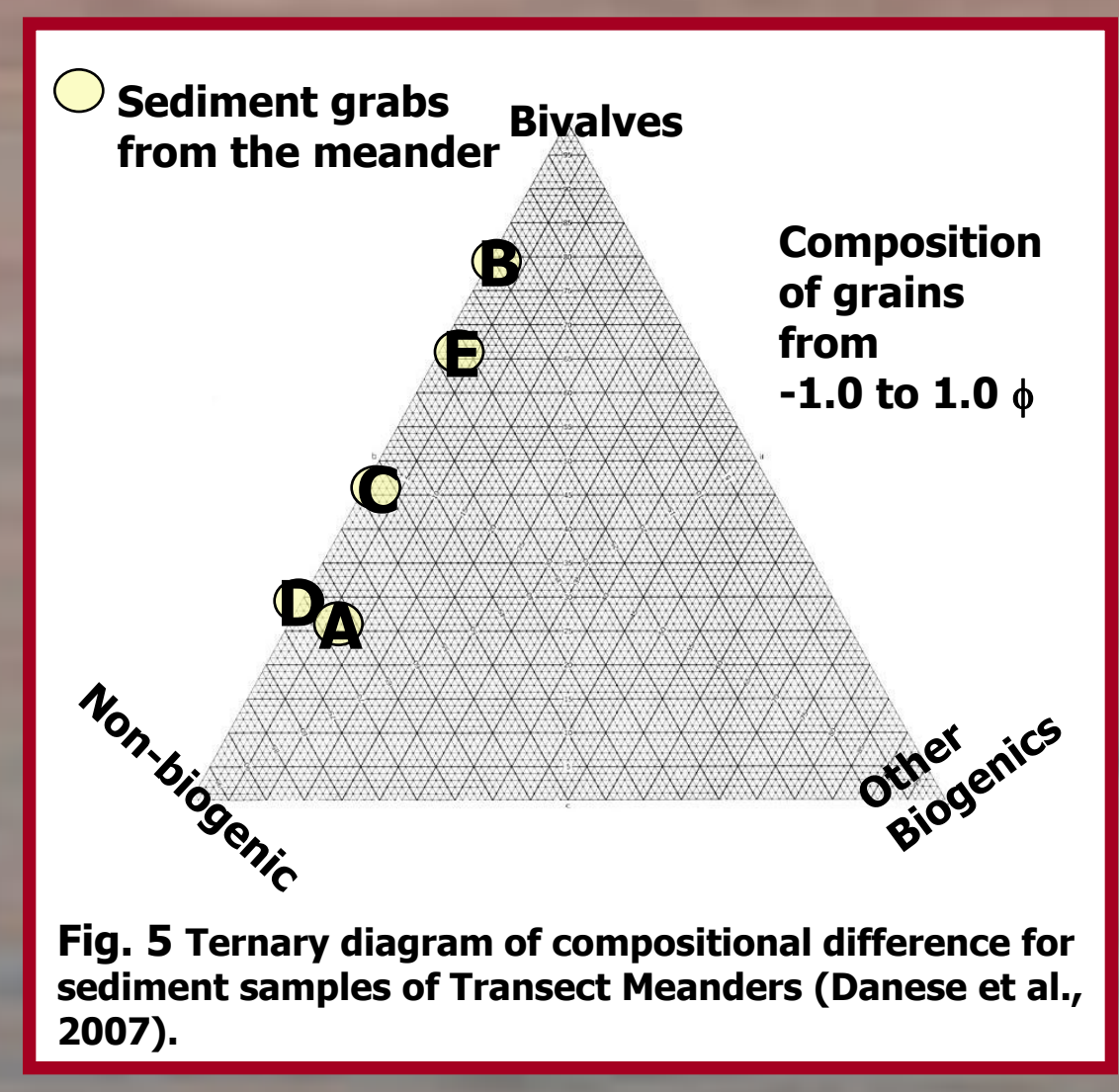


Fig. 5 Ternary diagram of compositional difference for sediment samples of Transect Meanders (Danese et al., 2007).

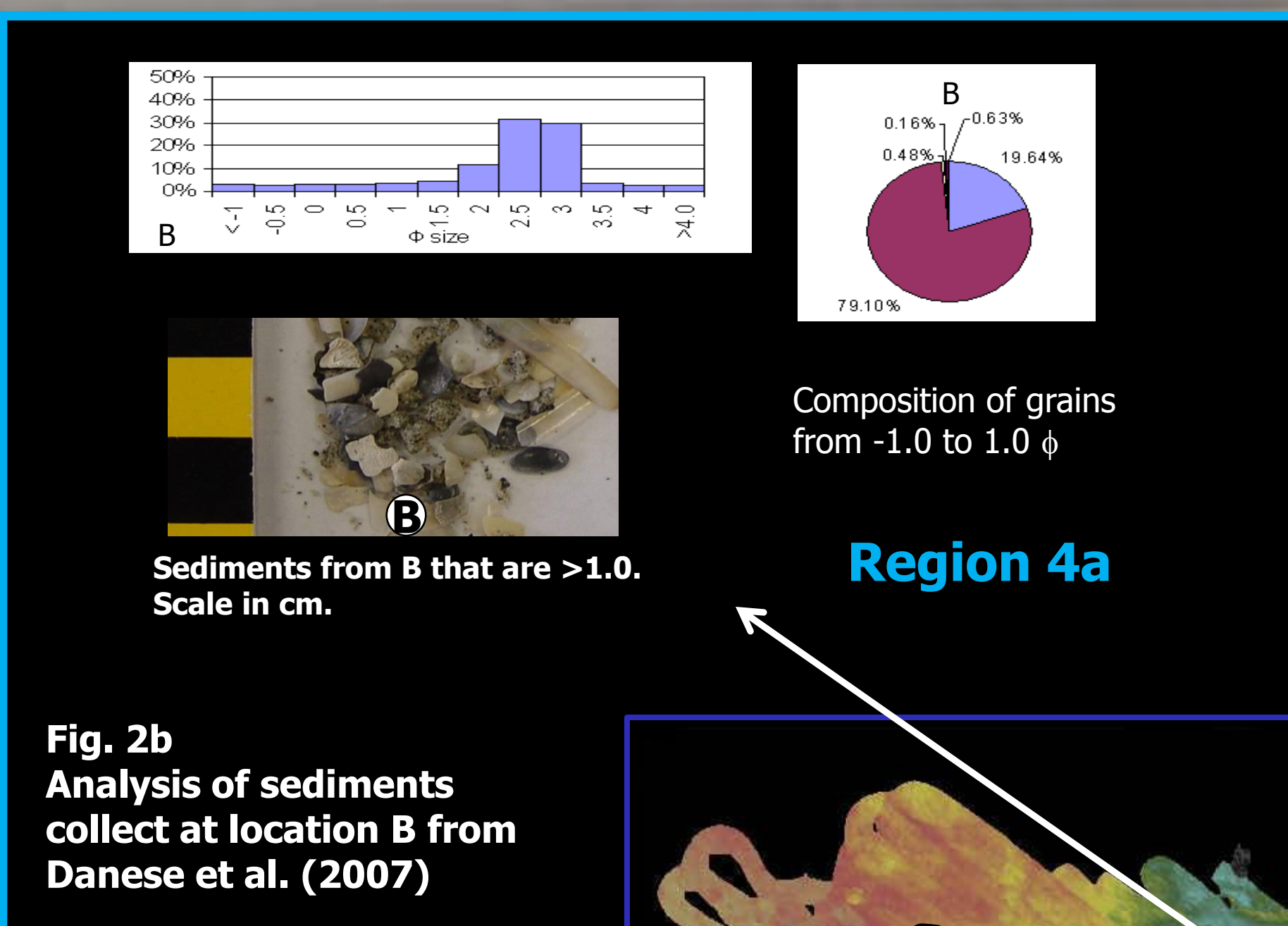


Fig. 2b Analysis of sediments collect at location B from Danese et al. (2007)

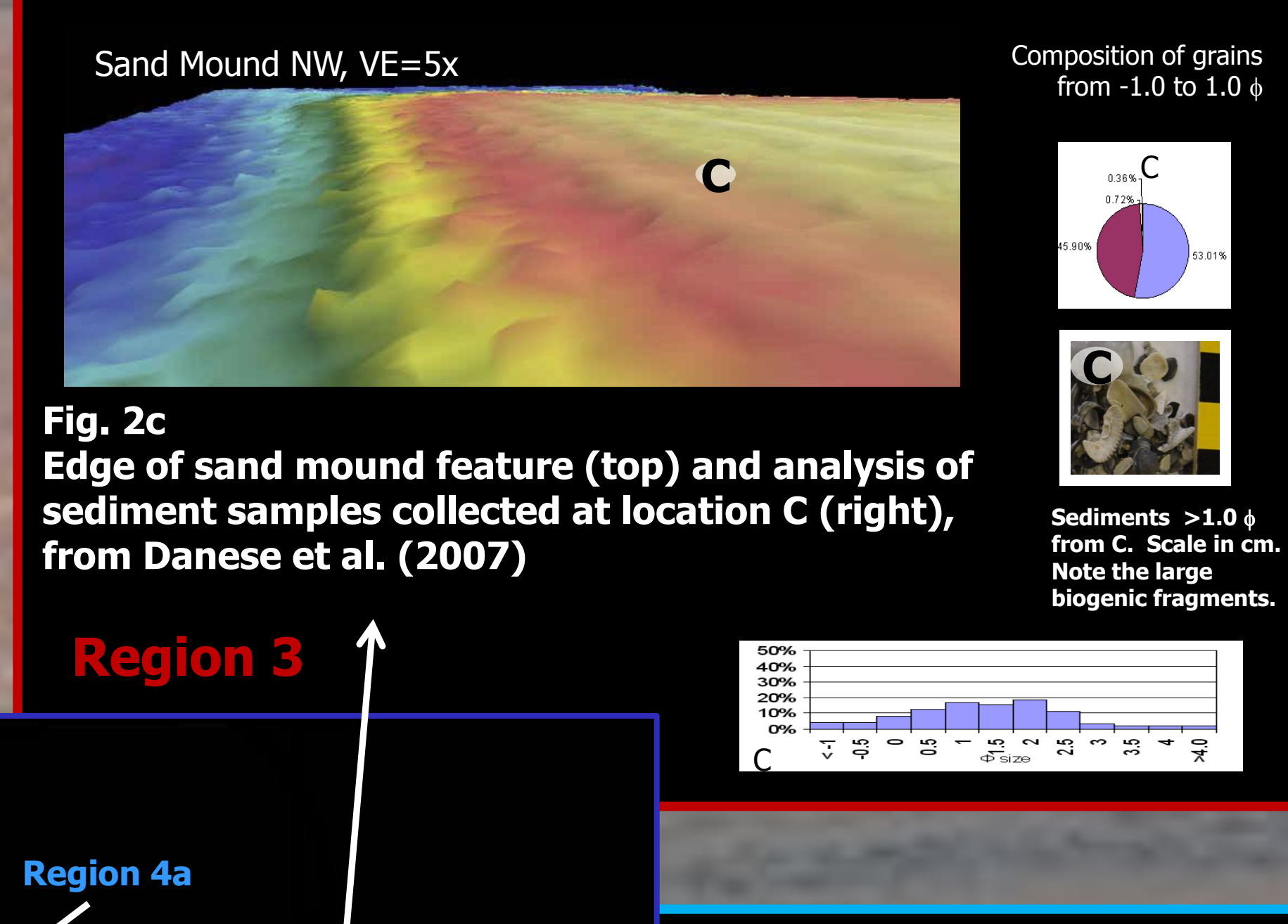


Fig. 2c Edge of sand mound feature (top) and analysis of sediment samples collected at location C (right), from Danese et al. (2007)

Classification of sediment samples for Pi-graph analysis (Danese et al., 2007)

- Nonbiogenics
- Bivalve Fragments
- Bryozoa
- Benthic Foraminifera
- Planktonic Foraminifera
- Gastropods

RESULTS

The survey area was divided into four distinct regions based on the geomorphology from multibeam sonar, previous photographic data (Stubbs et al., 2007) and sediment analyses (Danese et al., 2007):

REGION 1 includes the extent of the Transect Meanders, trending NW-SE along the shoreward side of the survey area, with water depths ranging 19 - 24 m and relief ranging 0.5 - 1.5 m. The region contains sedimentary deposits consisting mostly of gravel and medium to fine-grained sand with large amounts of very coarse authigenic and phosphorite grains. ROV and SCUBA images revealed that lithified exposures and eroding hardground associated with this feature support a wide variety of marine life.

REGION 2 includes the linear features located in the southeastern portion of the survey area, which trend NW-SE and have lengths as great as 500 m. To date, no sedimentary data are available for Region 2.

REGION 3 contains the massive sand body found in the southeastern portion of the survey area which is composed mostly of medium to coarse-grained sand. The sand body is a very flat feature with low relief (Hairston-Porter et al., 2008) and contains the shallowest areas (19 m) within the survey region.

REGION 4 is characterized by low-lying basins located in the northwestern and southeastern portions of the survey area, each of which have depths as great as 25 m. Sediment grabs from this region contain mostly biogenic material comprised of bivalve fragments.

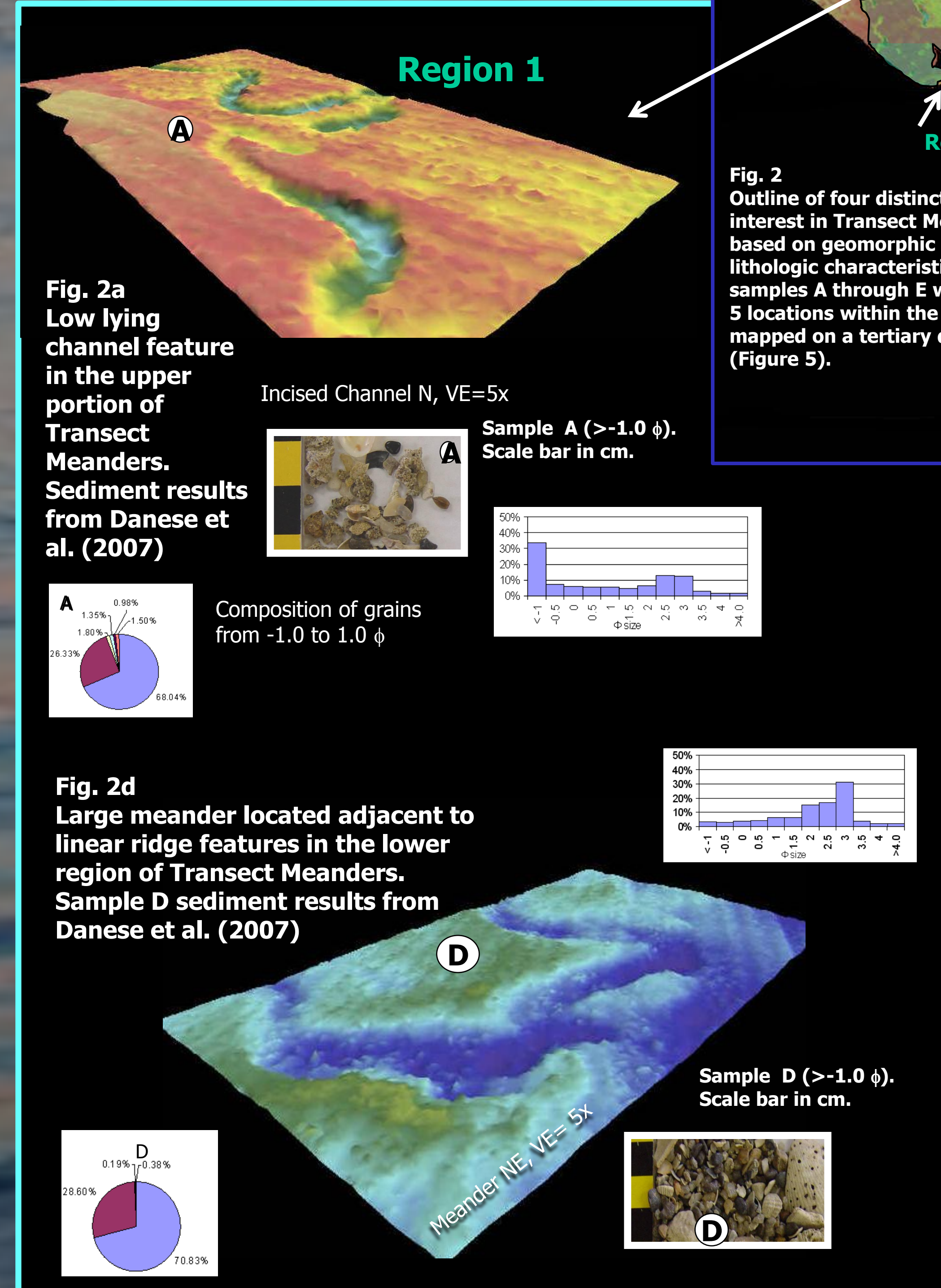


Fig. 2a Low lying channel feature in the upper portion of Transect Meanders. Sediment results from Danese et al. (2007)

Fig. 2d Large meander located adjacent to linear ridge features in the lower region of Transect Meanders. Sample D sediment results from Danese et al. (2007)

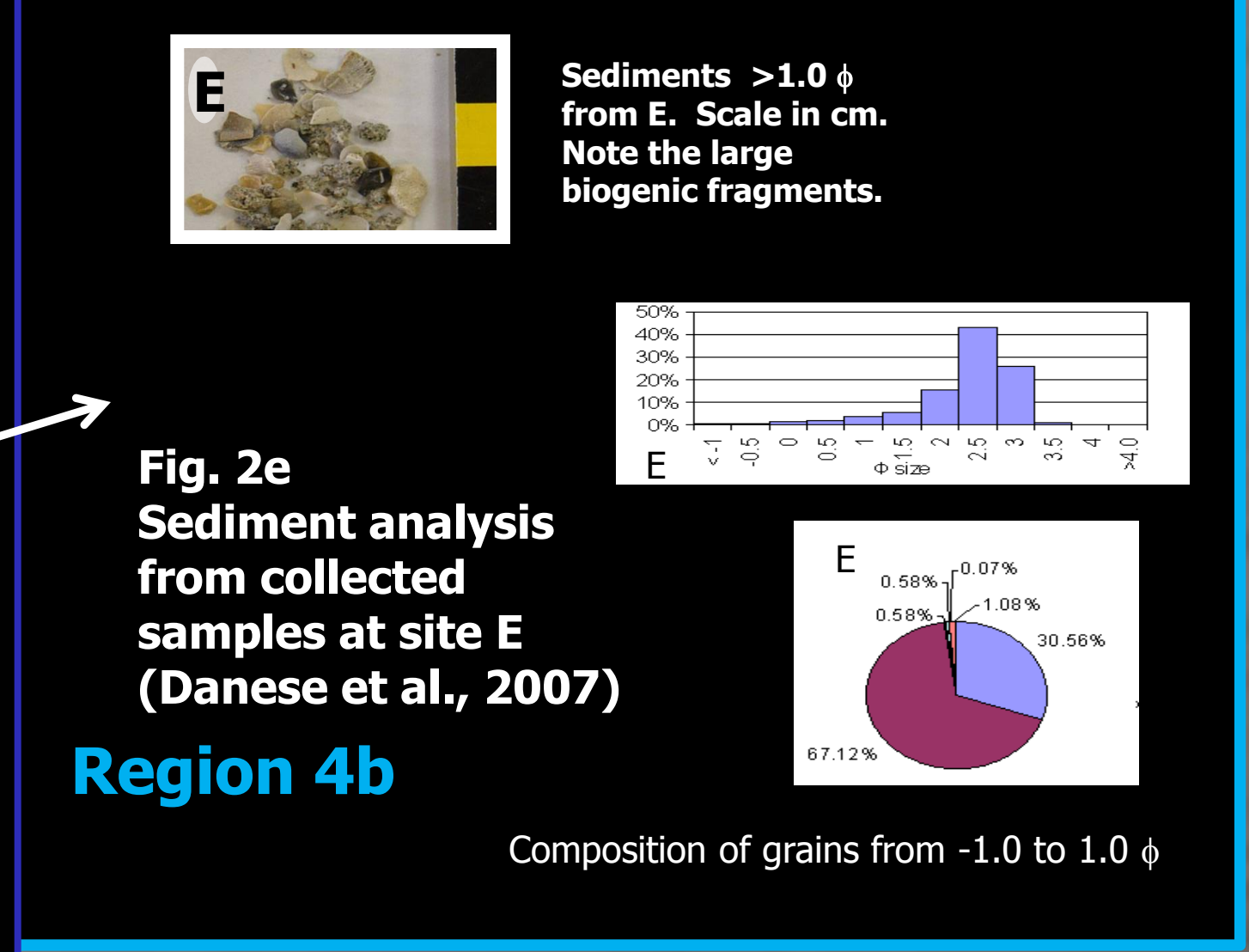


Fig. 2e Sediment analysis from collected samples at site E (Danese et al., 2007)

DISCUSSION

- Multibeam data, surveyed on the continental shelf 30 km off the Charleston coast, reveal distinct features which suggest this region likely marks the approximate paleo-shoreline during the Younger Dryas (11,000 ybp) when sea level was 20 - 25 m below its modern position.
- The Transect Meanders area was characterized by dividing the survey area into four distinct regions (1-4), based on bathymetric features and sediments collected and analyzed by Danese et al. (2007). These four regions provide a geologic background for determining the modern environments and habitat characteristics.
- Region 2, which contains the extensive linear features believed to be dune (sand) waves (Murphy, 2007), is a region that was not analyzed for its sedimentary components. The expanse of this feature suggests that it could represent outcrops of underlying rock layers. Region 2 is one that should be further analyzed, through both sediment sampling and various forms of acoustic signaling, to determine the origins of these linear features.

REFERENCES AND ACKNOWLEDGEMENTS
Danese et al., 2007; Harris et al., 2007; Murphy, 2007; Stubbs, 2007; Meany, 2007 : Geological Society of America Abstracts with Programs, Vol. 39, No. 2, p. 15.
Hairston-Porter et al., 2008: School of Science and Math Poster Session, College of Charleston
CARIS, Inc., for software; NOAA Ship *Nancy Foster*; Josh Mode for assisting with instruction