

Developing a State-of-Knowledge (SOK) Report for the Georgia Bight as Part of the South Carolina-Georgia Coastal Erosion Study (Phase II): Initial Findings

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1. PROJECT OVERVIEW

The South Carolina-Georgia Coastal Erosion Study (2000-2003) is a USGS cooperative program administered through the South Carolina Sea Grant Consortium. The Georgia portion of this study focuses on ~225 km of coast in the Phase II Southern Study Region between St. Helena Sound, SC and Cumberland Sound, GA. The goals of the Georgia research are:

- To determine historical rates of shoreline change in Georgia and southern South Carolina using rectified aerial photography and T-sheets, and
- To generate an SOK Report for the apex of the Georgia Bight that synthesizes existing geo-knowledge and identifies data gaps in our understanding of coastal processes and geology.

Results from the Southern Study Region will be used as tools in coastal management and as a guide for future geologic research on the Georgia Bight.

2. SOK PROJECT APPROACH

The SOK component of the Georgia Study involves the following approach:

- Search print and online literature collections and databases from academic institutions; private industry; and municipal, state, and federal agencies to locate grey and formally published geo-documents relating to the Georgia Bight
- Compile, analyze, and categorize information on coastal processes and change, coastal and inner shelf stratigraphic frameworks, and coastal management & engineering
- Synthesize information and develop paper, digital CD, and online versions of a State-of-Knowledge Report and bibliography for the Georgia Bight that identifies geo-data gaps and opportunities for future research

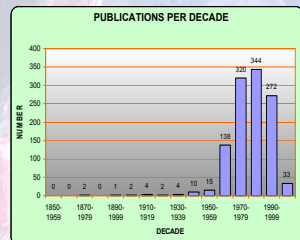


FIG. 1

3. GEO-RESEARCH HISTORY

Coastal research on the Georgia Bight began in the mid 1800s (Fig. 1) with groundwater (4; Fig. 2) and coastal-navigation enhancement (1; Fig. 2) projects. Research expanded rapidly during the 1960s and peaked during the 1980s, with an increased emphasis on coastal sedimentology and shallow lower coastal plain stratigraphy (3; Fig. 2).

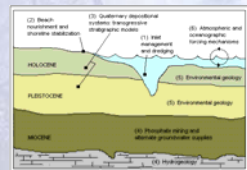


FIG. 2

In the 1990s and 2000s, coastal research is focused primarily on hydrogeologic and environmental geologic issues (1, 2, 4, 5, & 6; Fig. 2) associated with the impacts of an expanding coastal population (water resources, pollution and coastal hazard mitigation).

4. GEO-RESEARCH THEMES

To date, a growing bibliography of ~1200 documents and a 30-level classification scheme indicate that coastal research at the apex of the Georgia Bight has focused on six major theme areas (Figs. 2, 3):

- Inlet processes, morphology, and dredging: associated with navigation enhancements at ebb-dominated inlets for commercial, recreational, and military purposes (INL: 6%).
- Coastal management and engineering: associated with coastal erosion and beach stabilization on tourism-dependent barrier islands and coastal parks (CME: 29%).
- Sedimentology and shallow stratigraphy: focused on development of Quaternary passive-margin transgressive stratigraphic models (SED: 39%).

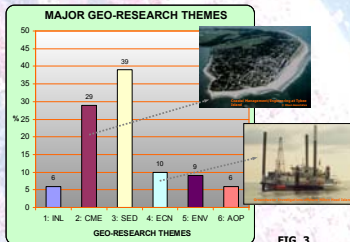


FIG. 3

- Lower coastal plain and inner shelf stratigraphy and economic geology: designed to quantify hydrocarbon, groundwater, and economic mineral resources (ECN: 10%).
- Environmental research focused on geo-biology, geochemistry, nutrient and pollutant cycling, and the influence of shallow subsurface heterogeneity on the hydrology of modern coastal systems (ENV: 9%).
- Atmospheric and oceanographic forcing mechanisms (AOP: 6%).

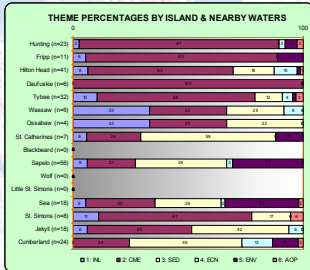


FIG. 4

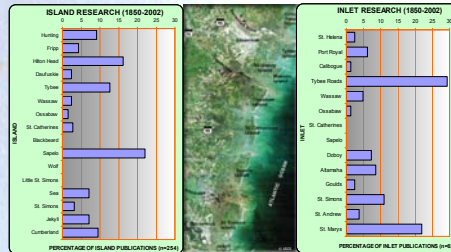


FIG. 5

5. INITIAL FINDINGS

Overall, Figure 3 illustrates that geo-research at the apex of the Georgia Bight focuses strongly on Quaternary transgressive stratigraphy (3:SED) and coastal management/engineering (2:CME). On the barrier islands, however, coastal management/engineering and inlet process (1:INL) studies supercede Quaternary stratigraphic research (Fig. 4). These coastal management/engineering studies are conducted primarily on Hunting, Frigg, Hilton Head, and Tybee Islands by federal/state agencies and coastal-engineering companies. New work on Daufuskie Island, an evolving "resort community," centers exclusively on beach nourishment and erosion mitigation.

The second most prevalent avenue of research on the barrier islands (Fig. 4) centers on the development of high-resolution transgressive stratigraphic models for tide-dominated passive continental margins (3:SED). The majority of this research was conducted within academia, almost exclusively on the Georgia coast, and particularly on and in the vicinity of Sapelo, Jekyll, and Cumberland Islands between the 1960s and mid-1980s.

Coastal geology data is absent from three islands on the Georgia coast (Figs. 4, 5; Blackbeard, Wolf, and Little St. Simons Islands). In general, shallow stratigraphic data is sparse on federal- and state-managed islands such as Little Tybee, Wassaw, Osabaw, and Blackbeard Islands; Jekyll and Cumberland Islands are exceptions. On the South Carolina coast, there is a lack of stratigraphic framework data for Hunting, Frigg, and Daufuskie Islands.

Excluding barrier island areas, much research has focused on evaluating economic-mineral (heavy-mineral sands, phosphate) and groundwater potential. The majority of this work (4:ECN) was conducted by federal agencies and exploration companies on the lower coastal plain, in marshes, and offshore. Hydrogeologic studies have generated a large amount of drilling and geophysics data and have led to a good understanding of pre-Quaternary stratigraphy.

Most recently, environmentally-driven shallow stratigraphic investigations (5:ENV) have become prevalent. Research is being conducted primarily within academia and is focused on Cumberland and Sapelo Islands, and on estuaries such as the Satilla, Altamaha, and Savannah.

6. PRELIMINARY DATA GAPS AND RESEARCH OPPORTUNITIES

- There has been extensive study of barrier island erosion problems and shoreline change on Hunting, Hilton Head, Tybee, Sea, and Jekyll Islands. However, these islands are highly human-modified and results may not be applicable to natural barrier systems. To date, shoreline change rates and trends (both long and short term) are poorly documented outside of these areas, largely because a regular coastal monitoring program does not exist for the Georgia coast.
- A major need exists for high-resolution geophysical mapping of Quaternary lagoon-inlet-shoreface depositional system frameworks. Existing data are sparse, poorly "linked," of poor quality, and have limited georeferencing. Depths to the base of the Holocene and Pleistocene strata are poorly quantified along the beach-upper shoreface transition and also at inlets where semi-lithified Miocene outcrops may have a major effect on inlet morphodynamics.
- Much geologic data has been collected on the coast and inner shelf. However, poor sample quality and difficulties in recovering/relocating samples means that collection of new data may be a more viable alternative to recovery of these old data for any future research on coastal depositional systems.
- There is a critical lack of georeferencing for surficial and subsurface sediment samples and for all geophysical data on the apex of the Georgia Bight. Georeferencing within a GIS would greatly facilitate future coastal research.
- Detailed imagery on shoreface-inner shelf geomorphology and substrates is lacking and is a barrier to identifying beach-shoreface-shelf sediment dispersal pathways and mechanisms. This gap could be remedied by sidescan sonar and multibeam bathymetry surveys.
- In general, shallow Quaternary frameworks, patterns and causes of historical shoreline change, inlet processes and sand bypassing, and up-to-date sediment transport numbers are not well understood for over half of the islands on the Georgia Bight. This data gap could be remedied by physical monitoring, GPR, and high-resolution reflection seismics.