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Research in Progress*

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The Institute of Oceanography, Old Dominion University, Norfolk, Virginia, has augmented its staff and activities during 1968. John C. Ludwick, geological oceanographer, formerly of Gulf Research Corporation, has been appointed director. Other new staff members are Donald Swift, geological oceanographer, formerly of Duke University; Ronald Johnson, physical oceanographer, formerly of Oregon State University; and Frank Slowey, chemical oceanographer, formerly of Texas Christian University. Jacques Zaneveld, biological oceanographer, preceded the expansion. The Institute operates a 60-foot coastal vessel and utilizes larger Coast Guard vessels stationed nearby. The Institute has an active master's program and a doctoral program is contemplated.

Two research projects are presently underway. The first, headed by Ludwick, is a study of the large ($80km^2$) sand shoal blocking the northern half of the mouth of Chesapeake Bay (Figure 1). Reconnaissance studies suggest that this sand body is the terminus for the littoral-drift system of the Delmarva peninsula, between Chesapeake and Delaware bays. The rectilinear, tidal regime of the bay's mouth has structured the upper surface of the sand bodies into a complex hierarchy of ebb-flood channel systems, similar to those described by Van Veen (1950) from the southern bight of the North Sea. The successive, arcuate, channel systems may indicate incremental southward progradation of the shoal since the late Recent reduction in the rate of sea level rise.

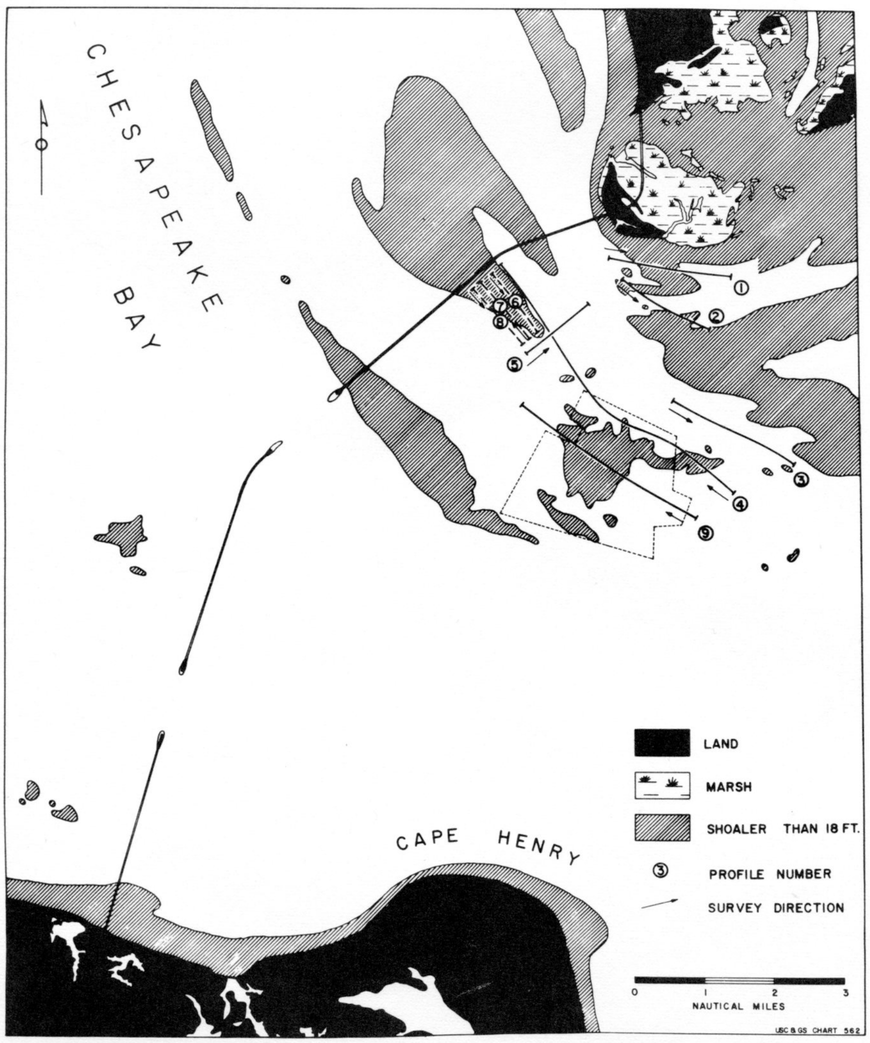

Fig. 1
Tidal entrance to Chesapeake Bay, Virginia.
Principal natural passages are 92 and 55 feet deep. Shoals predominate in the northern one-half of the inlet. Surface currents up to 3.4 knots occur occasionally in some channels. Sand waves 5-10 feet in height, 200-800 feet in wave-length occur atop shoals and in channels. Sand wave migration constitutes an important sediment shifting mechanism in this area.

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The study of the baymouth shoal is being pursued along four paths

1. Analysis of sediment distribution
2. Analysis of hydraulic regime
3. Analysis of water-substrate interaction and sediment transport
4. Geologic history and probable future of the shoal.

Topic number 3 will emphasize especially the shoal as a natural laboratory for the study of the dynamics of tide-maintained sand-wave fields.

A second project is headed by Swift and supported by the Coastal Engineering Research Center and the U.S. Geological Survey. It is an analysis of the dynamics of coastal and inner-shelf sedimentation between Cape Henry, Virginia, and Cape Lookout, North Carolina, with special emphasis on the False Cape, Virginia, area.

The regional portion of the study will test the following hypotheses

1. The first hypothesis states that a nearshore, modern, sand prism consisting of barrier island, spit, or mainland beach, and seaward thinning and fining blanket of modern sand that has been built since the late Recent reduction of sea level rise. It overlies a shelf, relict, sand blanket. The two facies are distinguishable by petrographic criteria.

2. The coastal sector under study is a typical, middle-Atlantic, coastal compartment in that it consists of an eroding headland to the north, south-trending spit, and a barrier-island sequence extending south of the spit. The second hypothesis states that there are three sediment sources for the nearshore, modern, sand prism in such cases, namely headland erosion, submarine erosion in the surf zone, and landward movement of shelf sand. The hypothesis further states that the latter two sources increase at the expense of the first as the nearshore, modern, sand prism is traced south. Heavy mineral analysis has been undertaken as a specific test.

Initial bottom sampling and profiling between Cape Henry and Cape Hatteras (Figure 2) indicates that as previously reported (Emery, 1965) the nearshore-modern and offshore-relict facies of this coast are readily distinguishable on the basis of grain size (offshore sands are coarser), pigment (offshore sands are iron stained), fossil content (offshore sands contain depth-anomalous fossils), and the ratio of opaque to nonopaque heavy minerals (offshore sands contain over 40 percent). The latter parameter also varies systematically down the length of the nearshore modern sand prism.

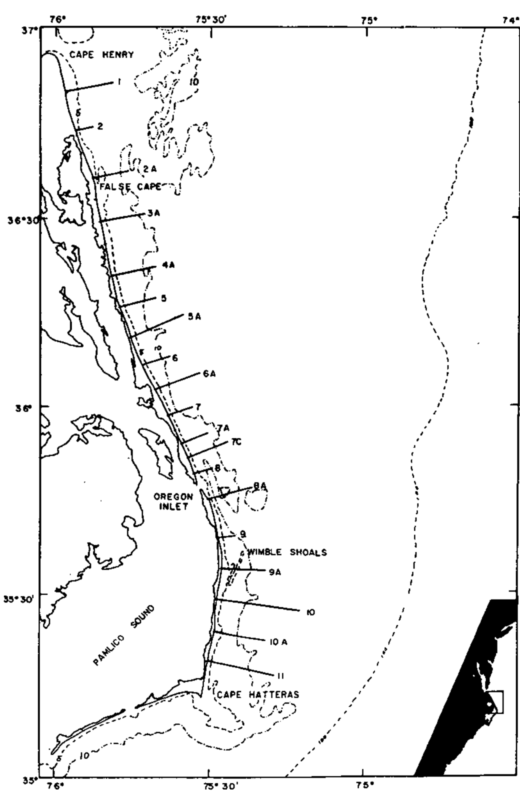

Fig. 2 Completed transects of bottom sampling and profiling, inner shelf of Virginia and North Carolina.

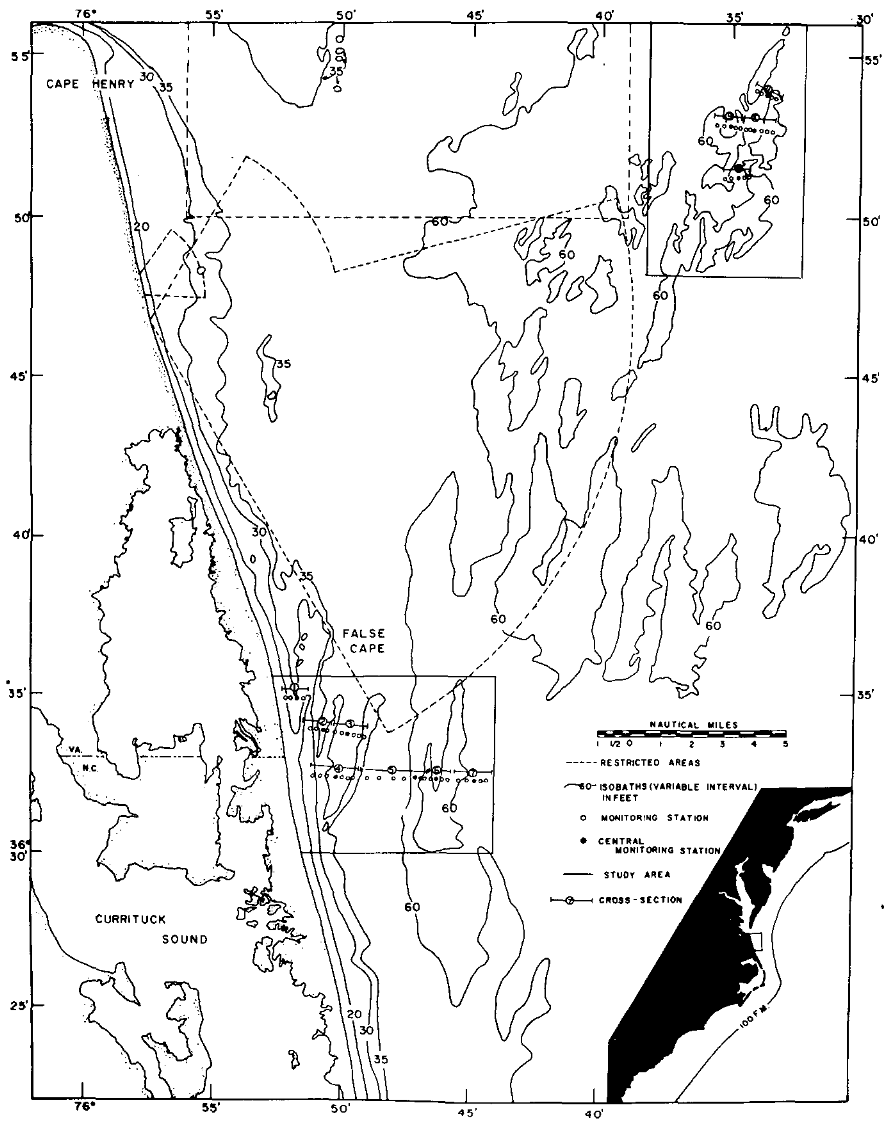

Fig. 3
Lower study area is the False Cape study area, referred to in text. Designated stations are for the current meter study. False Cape shoals have been referred to by Sanders (1962) as a relict, beach-ridge complex, but resembles the large-scale, dynamic bedform referred to by Robinson (1966) as a Ness. The offshore ridges have also been referred to as relict beach ridges (Shepard, 1963, p. 213). Uchupi (1968) has recently suggested that these, too, are dynamic bedforms.

The initial study has shown that the nearshore, modern, sand prism wedges out within 5 to 10 km of shore, in about 15 metres of water. At capes such as Henry and Hatteras, however, changes in incident wave energy and the tidal current system result in much flatter and shoaler shoreface profiles and, in the case of Diamond shoals off Cape Hatteras, extension of the nearshore, modern, sand prism toward the shelf edge.

During the coming year, textural and heavy mineral analysis of samples from the regional reconnaissance will continue. Field work will be extended south from Cape Hatteras to Cape Lookout, and will be implemented by coring and sub-bottom profiling, both onshore and offshore.

In addition to the regional study, an intensive study of the dynamics of inner shelf sedimentation will be undertaken in a 10 km by 14 km area off False Cape, Virginia (Figure 3).

The area will, during the coming season, be profiled, sub-bottom profiled, and sampled on a 1-km grid, using the Alpine digital radar ranging system for navigation. A transect, normal to the shore, of 10 diving stations will be established. The stations will be monitored on a monthly basis for $1\frac{1}{2}$ years to record changes in bottom level, primary structures, and textures. The hydraulic regime will be monitored with recording current metres. The program is designed to determine: 1) the character of the fair-weather, and storm, hydraulic regimes and their respective effects on the substrate; and 2) the extent to which the ridge and swale topography on the inner Virginia - North Carolina shelf is a relict littoral topography and the extent to which it consists of tide- or storm-generated bedforms.

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