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RECOGNITION OF BEACH AND NEARSHORE DEPOSITIONAL FEATURES OF CHESAPEAKE BAY

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ABSTRACT

Beach and nearshore depositional features are being mapped with the objectives of determining a quick-look analysis of littoral drift and sedimentation patterns in areas of little or no data. Evaluation of beach and nearshore features aid in the selection of small boat harbors, shoreline protective structures, and general coastal zone development.

Through ERTS-1 aircraft support imagery, beach depositional features mapped are cuspate forelands, welded beach ridges, and recurved spits. The nearshore depositional features exhibit a bar and trough topography with three distinct types of sedimentary structures; longshore, transverse, and reticulated bars. Synoptic coverage of beach and nearshore depositional features by ERTS-1 data help in determining the general sedimentation patterns, growth of the beach features and stability of the bar and trough topography.

1. INTRODUCTION

The Chesapeake Bay region of Maryland is an area of intense research into the physical, chemical, and biological aspects of the marine sciences. One area that has received little investigative research has been the beach and nearshore environment and related sedimentary structures. Kindle (1936) was the first to note the nearshore sand bars of Chesapeake Bay. Since Kindle's notes, the Maryland Geological Survey has conducted preliminary observations on the nearshore sand bars in a cooperative program with the Coastal Engineering Research Center at Chesapeake Bay, Maryland. With the enactment of the Coastal Zone Management Act of 1972 and a proposed House Joint Resolution by the State of Maryland, more emphasis is now being conducted into the coastal zone of Maryland. Using ERTS-1 aircraft support imagery, beach and nearshore depositional features of Chesapeake Bay are being mapped and described with the objectives of developing for the State of Maryland a geological baseline for the coastal zone (Figure 1.)

Beach Depositional Features

Beach depositional features are uncommon to Chesapeake Bay especially with the shore erosion problems that exist. The beach sedimentary structures occupy a small percentage of the total area of Chesapeake Bay and are

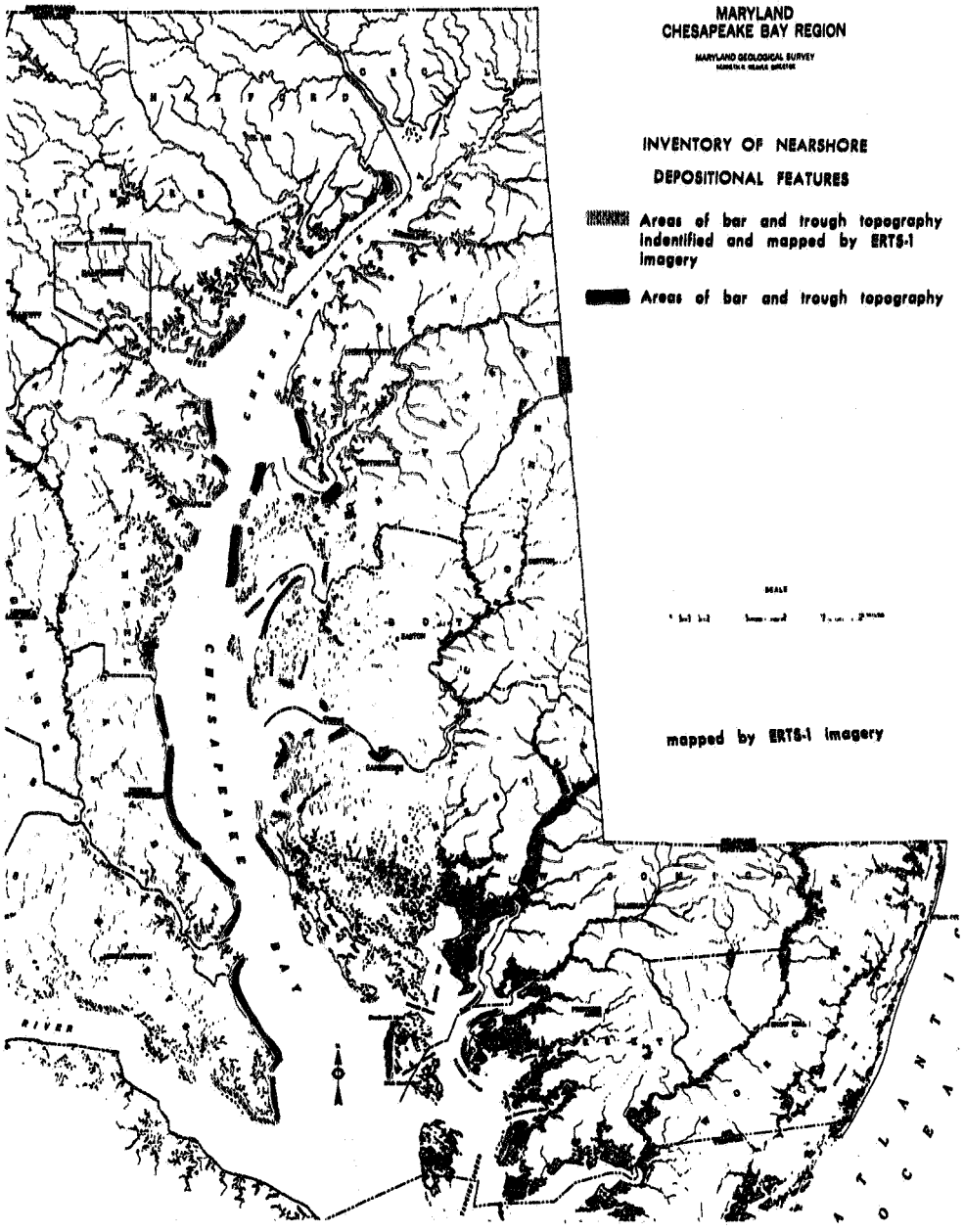

Figure 1. Preliminary distribution map of the nearshore depositional feature of Chesapeake Bay

generally localized. Features being mapped by ERTS-1 aircraft support imagery are baymouth bars, recurved spits, and cuspate forelands.

One area of interest is the Long Beach-Flag Ponds community of Calvert County. As shown by Figure 2, the depositional features are a series of beach ridges and a secondary recurved spit developed on a straight reach of coastline. Historically, the cape of Flag Ponds has migrated southward over distance of 1500 feet from 1847 to 1945 with linear recession of approximately 300 feet on the east shore (Singewald & Slaughter, 1949).

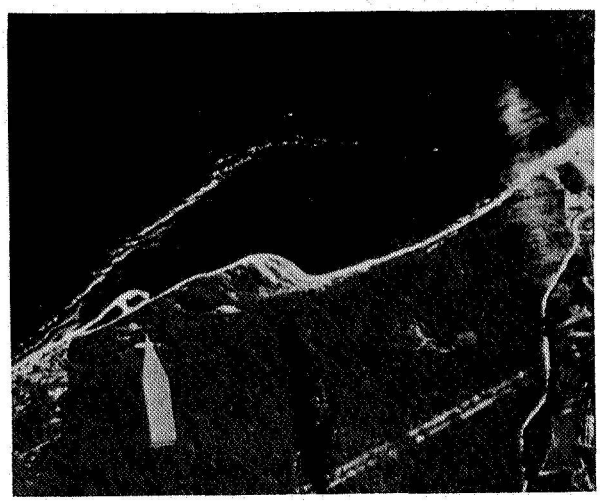

Figure 2. Aircraft support (Wallops-NASA) imagery of Flag Ponds, Oct. 1972, a cuspate foreland and recurved spit forming on a straight reach of coastline. Note breaking wave pattern

The development of the secondary beach feature, the recurved spit, first appeared in the mid-1960's. The young age of the recurved spit suggests a massive introduction of sediment into the nearshore environment, north of the Flag Ponds area. One possible explanation is that in 1949 the Long Beach harbor was dredged and disposal of the sediments was south of the harbor jetties. With a predominate southerly drift direction, the disposal sediments migrated southward. Accumulation of the sediments as a recurved spit appears related to the wave refraction pattern (Figure 2) and creation of a reverse current direction. Schubel (1972) also suggests a reverse current or eddy system for the Flag Ponds area. The migration of the nose of the spit has progressed in the southerly direction. The growth of the recurved spit has occurred in "spurts" and not as a continuous growth pattern. Each additional growth of the recurved spit appears related to the occurrence of a preceding northeast storm.

Nearshore Depositional Features

Prime prerequisites of nearshore sand bars are gradually sloping nearshore bottom and abundant sand supply (Davis and Fox, 1972). A gradually sloping nearshore bottom is evident in Chesapeake Bay as indicated by hydrographic charts. Abundant sand supply is being introduced into Chesapeake Bay from the eroding shoreline and not by the major river systems. (Schubel, et.al., 1972)

Figure 1 is a preliminary distribution map of the nearshore bottom structures. The major nearshore bottom as indicated by the darkened pattern have been previously known but ERTS-1 aircraft support imagery has supplied the capability to delineate, describe and interpret these structures.

The predominate sand bar type is the longshore bar and is confined to areas of generally straight coastlines. The length of straight coastline does not appear to influence longshore bar and trough development as seen by longshore bar development in the subestuaries where small lengths of coastline are prevalent. The longshore bars are generally parallel to the shoreline and to each other and continue along the coast until the structures are interrupted by headlands or natural tidal channels. The longshore bars are diverted in the offshore direction and diffused into a shoal area with or without a reticulated bar pattern. For example, parallel longshore bars exist along a straight coastline of Calvert County from Herring Bay to Plum Point. As the longshore bars approach Plum Point, a prominent headland, the longshore bars diffused into a shoal area without a reticulated bar pattern adjacent to Plum Point (Figure 3), whereas along Eastern Neck in Kent County, the longshore bars are diverted offshore by a tidal channel and develop a shoal area with reticulated bar pattern (Figure 4).

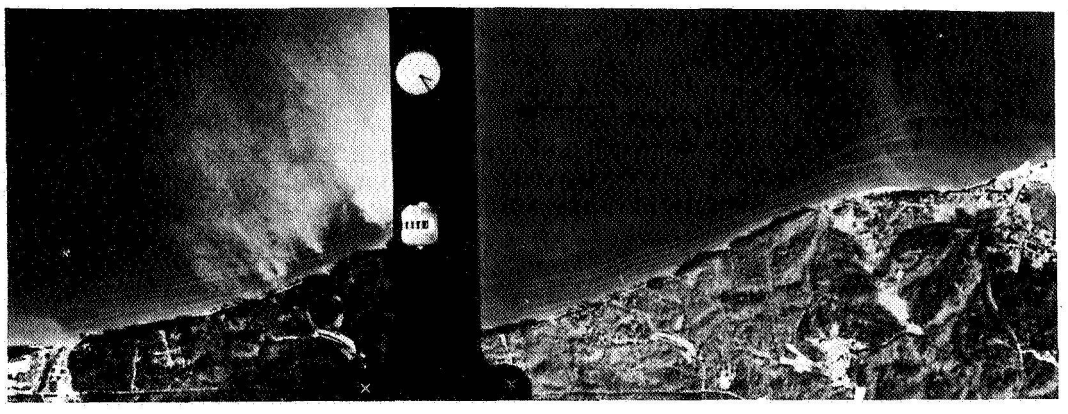

Figure 3. Aircraft support (Wallops-NASA, Oct. 1972) imagery of Longshore Bar-system diverted by prominent headlands. Plum Point at Chesapeake Beach, Maryland

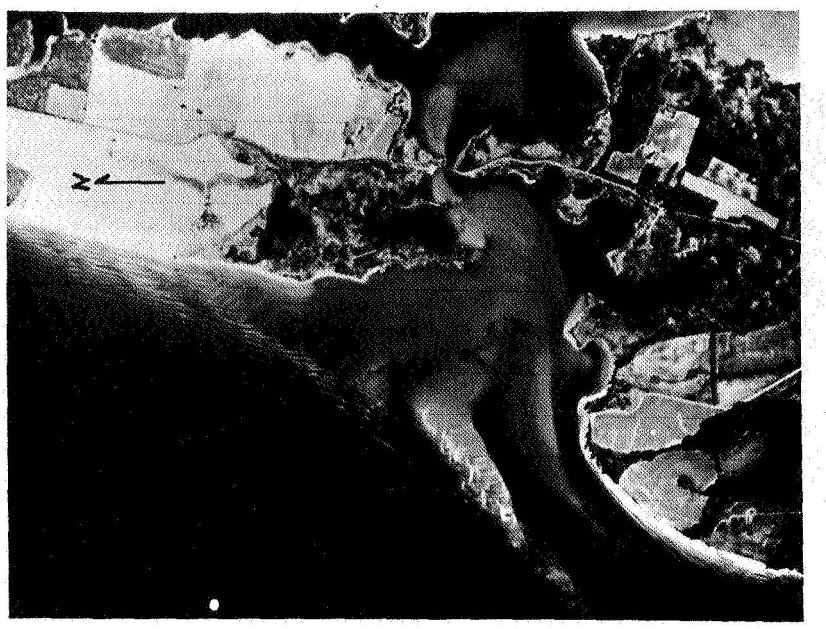

Figure 4. Aircraft support (Wallop-NASA) imagery Oct. 1972, of Longshore bar system diverted by natural tidal channel at Eastern Neck Island

The number of longshore bars may be as many as fifteen and generally increase in size and wavelength in the offshore direction (Figure 5). In some areas, two distinct sets can be delineated, an inner set of closely spaced, small amplitude bars and an outer set of widely spaced, large amplitude bars interrupted by a natural channel. The intervening channel is wider than the corresponding trough dimensions which allow for division of the bars into two sets. Bifurcation and a sinuous form are common features of the longshore bars particularly the inner nearshore longshore bars. Along a longshore bar, the bars exhibit high pockets of sand with intervening low areas or saddles and appear to be related to bifurcation of the bar form.

Summary

With the capability of the ERTS-1 aircraft support imagery, the beach and nearshore depositional of Chesapeake Bay are being mapped and a geological baseline of the coastal environment is being developed. The beach features are uncommon to Chesapeake Bay and are localized features. Baymouth bars, recurved spits, and cuspate forelands are the common features. The nearshore depositional features exhibit a longshore bar and trough topography and generally confined to straight reaches of shoreline. The longshore bars may number as many as fifteen and increase in size and wave length in the offshore direction.

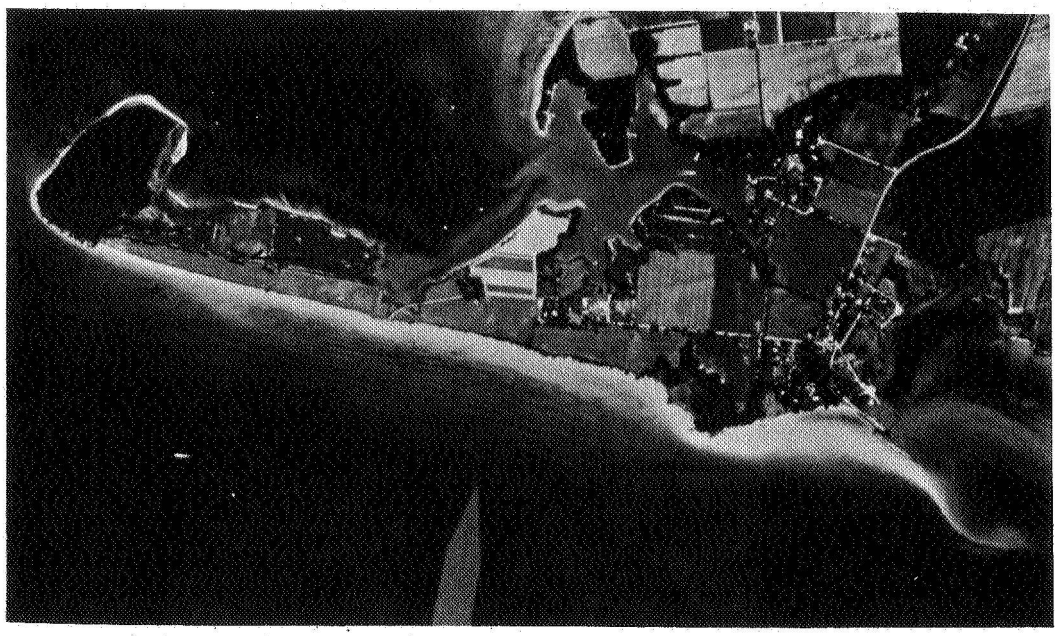

Figure 5. Aircraft support (Wallops-NASA) Oct. 1972 imagery Rich Neck exhibiting typical longshore bar and trough system of Chesapeake Bay

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