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Annotated Chronological Bibliography of Barrier Island Migration

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INTRODUCTION

A major thrust of coastal barrier research has involved island migration. The dynamic nature of these barrier landforms is one of their inherent characteristics. As sea levels have risen during the Holocene, unconsolidated cliffs have retreated by erosion, while barrier islands have been essentially maintained by rolling landward through time.

Most of the early (pre-1970) papers on barrier island migration were based on post-storm observations. The decade of the 1970s was an era of intense investigation of barrier dynamics (overwash, inlet and aeolian processes), chiefly by geomorphologists but also involving coastal ecologists and engineers. The Academic Press book *Barrier Islands* (LEATHERMAN, 1979) brought all the principal North American research together for the first time to provide a unified picture on a morphodynamic, stratigraphic and geographical basis.

This annotated chronology traces the development of the major concepts and their evolution through time (until 1980). A recent special issue of *Marine Geology* (OERTEL and LEATHERMAN, 1985) brings the research up-to-date for the interested reader. It is hoped that this annotated bibliography will provide a good basis to evaluate the present state of knowledge and foster further research and development in this exciting field of scientific inquiry.

ANNOTATED BIBLIOGRAPHY

HOWARD, A.D., 1939. Hurricane modification of offshore bar of Long Island, New York. *Geographical Review* 29, 400-415.

Study area: South Shore of Long Island, New York.
Methodology: Post-storm observations.
Comments: Eight inlets were created by 1938 hurricane (storm surge of 15 ft). Absence of inlets in some stretches probably due to uniform height of high ridge crest; inlets presumably opened at low places in foredune. Some inlets probably started as washovers. Washover deposits were often 3 ft deep and extended 300-400 ft landward. No storm berms or beach ridges were created by this severe storm.

NICHOLS, R.L. and A.F. MARSTON, 1939. Shoreline changes in Rhode Island produced by hurricane of September 21, 1938. *Geological Society of America Bulletin*, 50, 1357-1370.

Study area: Rhode Island.
Methodology: Post-1938 hurricane observations.
Comments: Overwash deposition extended as much as 750 ft landward of eroded foredune, with sand deposition on the bayside, where the barrier was narrow. Three small, shallow inlets were cut through Napatree Beach. Inlets were localized by height and width of barrier and density of barrier vegetation. Barrier width was the most important factor in inlet breaching. Many small inlets were ephemeral, closed easily by littoral drift.

WILBY, F.B.; YOUNG, G.R.; CUNNINGHAM, C.H.; LIEBER, A.C.; HALE, R.K.; SAVILLE, T., and O'BRIEN, M.P., 1939. Inspection of beaches in path of Hurricane of September 21, 1938. *Shore and Beach*, 3, 43-47.

85001 received 10 January, 1985; accepted in revision 8 July 1985.

Study area: South Shore of Long Island, New York.
Methodology: Observations.
Comments: 1938 hurricane resulted in inlet truncation and overwash (3-4 ft deep deposits, extending 100-200 ft landward). Most of the overwash and several temporary inlets occurred where dunes had been leveled for building sites.

SHEPARD, F.P. 1953. Sedimentation rates in Texas estuaries and lagoons. *American Association of Petroleum Geologists Bulletin*, 37, 1919-1934.

Study area: Texas.
Methodology: Historical Coast & Geodetic Survey charts (quantitative).
Comments: Wind-blown sand (aeolian transport) and overwash along with flood tidal delta sedimentation are important elements of bay deposition, but these sources are not as significant as rivers.

FISCHER, A.G. 1961. Stratigraphic record of transgressing seas in light of sedimentation on Atlantic coast of New Jersey. *American Association of Petroleum Geologists Bulletin*, 45, 1656-1666.

Study area: New Jersey.
Methodology: Borings, coastal charts.
Comments: Growth and development of flood tidal deltas is the principal means of lagoonal deposition. Lagoonal salt marsh islands have developed on old tidal delta deposits.

SANDERS, J.E. 1963. Effects of sea level rise on established barriers. *Geological Society of America Special Pub. No. 115 (Abstract),* 73, 231.

Study area: U.S. East and Gulf Coasts.
Methodology: Observations.
Comments: Barrier drowning with sea level rise and insufficient sand was viewed as the norm, whereas continued landward migration by inlet dynamics and overwash processes was considered to be a rare and limited case.

MOODY, D.W. 1964. Coastal morphology and processes in relation to the development of submarine sand ridges off Bethany Beach, Delaware. Baltimore, Maryland: Johns Hopkins University, Ph.D. dissertation, 167p.

Study area: Bethany Beach, Delaware.
Methodology: Nearshore fathometer and beach profiles.
Comments: Overwash results in landward barrier migration with simultaneous erosion of ocean beach and deposition on bayside. Inlets are usually formed by bayside ebb surges and are localized in low parts of the barrier (old inlets or washovers). Over 32 yr period, shoreface erosion was nearly equal to sea floor aggradation in accordance with Bruun Rule.

HAYES, M.O. 1967. Hurricanes as geological agents: case studies of Hurricanes Carla, 1961, and Cindy, 1963. *Texas Bureau of Economic Geology, Report of Investigation No. 61,* 54p.

Study area: South Texas.
Methodology: Observations, shelf sediment samples.
Comments: Hurricanes play a major role in infilling of Laguna Madre by overwash and subsequent aeolian reworking of washover sands. Hurricane Carla resulted in large-scale ebb storm surge currents, depositing huge volumes of barrier sediments offshore (with thickness of several inches, over 10 miles offshore in over 120 ft of water). Hurricane Carla may have resulted in a net loss of sediment to the subaerial barrier (Padre Island).

SWIFT, D.J.P. 1968. Coastal erosion and transgressive stratigraphy. *Journal of Geology,* 76, 444-456.

Study area: Bay of Fundy.
Methodology: Observations.
Comments: Surf zone of transgressing sea will bevel the shoreface and may cut away partially (gentle slopes) or totally (steep slopes) the barrier sediments (ravinement process). Inlet migration is also a ravinement of barrier sediments. With landward barrier retreat and inlet migration, a double ravinement results. Concept of barrier overstepping is linked to the double ravinement process.

PIERCE, J.W., 1969. Sediment budget along a barrier island chain. *Sedimentary Geology* 3, 5-16.

Study area: Cape Hatteras to Cape Lookout, North Carolina.

Methodology: Field surveys (quantitative); historical Coast & Geodetic Survey charts and maps (quasi-quantitative).

Comments: Sediment budget concept can be used to (1) estimate sediment sinks and sources in a quantitative fashion and (2) make apparent data deficiencies and uncertaintities. Relative role of processes in landward migration: 70% inlets, 15% overwash and 15% aeolian transport. Shelf was believed to be a significant source (>40% of total) of sediment to barrier by onshore transport.

SCOTT, A.J.; HOOVER, R.A. and McGOWEN, J.H., 1969. Effects of Hurricane Beulah, 1967, on Texas coastal lagoons and barriers. *In*: A.A. Castanares and F.B. Phleger, (eds.), *Lagunas Costeras, Un simposio, (Coastal Lagoons, A Symposium)*. Mexico, D.F.: Universidad National Autonoma De Mexico, 221-236.

Study area: Texas.

Methodology: Observations, historical maps and charts (qualitative).

Comments: Hurricane Beulah (1967) resulted in large washover fans (sand deposit averaged less than 30 cm thick). Old inlet sites serve as active overwash areas for hundreds of years. Old maps indicate relative permanency of washover features through time. Washover sand is reworked by wind and blown into lagoons (important factor in landward barrier migration and lagoon infilling). Large washovers should be avoided for human development.

ANDREWS, P.B., 1970. Facies and genesis of a hurricane-washover fan, St. Joseph Island, central Texas coast. *Texas Bureau of Economic Geology Report No. 67,* 147p.

Study area: St. Joseph Island, Texas.

Methodology: Field surveys and observations.

Comments: A large washover fan, which has been in existence for several hundred years, is at the position of a relict flood tidal delta. Landward barrier migration is accomplished by (1) aeolian processes, (2) overwash processes, and (3) inlet dynamics.

DILLON, W.P., 1970. Submergence effects on Rhode Island barrier and lagoon and influence on migration of barriers. *Journal of Geology*, 78, 94-106.

Study area: Rhode Island.

Methodology: Shallow cores (10 ft) and seismic reflection profiles in lagoon only.

Comments: Sand supply believed to be the dominant factor in landward barrier migration. Lagoonal lobate fan deposits attributed to overwash. Use of surficial sand size to distinguish overwash and inlet sands. Landward barrier migration has maintained the shoreface profile of equilibrium. Barrier is rolling over itself and exposing lagoonal sediments on beach (inlets would truncate these sediments). Small-size barriers (due to lack of sand) can migrate landward by overwash, and thus Bruun Rule does not exactly apply. Concept that large barriers are forced to grow upward in place and cannot migrate landward is presented. Eventually, barrier growth cannot keep pace with accelerating requirement for sand with sea level rise and barrier may be drowned. Overwash believed to be principal process of landward migration based on present conditions (but all Rhode Island inlets are jettied and dredged).

GODFREY, P.J., 1970. Oceanic overwash and its ecological implications on the Outer Banks of North Carolina. *Office of Natural Science Studies, National Park Service*, Washington, D.C., 44p.

Study area: Core Banks, North Carolina.

Methodology: Shallow cores; quantitative vegetative sampling; elevation profiles across island.

Comments: Overwash deposits raised elevation of island interior by 8.4 cm in 10 years based on Corps of Engineer markers. Sand deposited into the bay by overwash acts as substrate for new marsh development and island retreat. Vegetative recovery by *Spartina patens* after overwash is a chief means of building barrier upward with sea level rise; barrier island is not "washing away." If overwash is too severe or occurs too frequently, then plants will not survive and barrier will remain low and barren. Overwash process (theoretically) allows for conservation of sand with sea level rise. Overwash stress keeps plants at low successional stage, as grasses, which results in high productivity.

OTVOS, E.G., 1970. Development and migration of barrier islands, northern Gulf of Mexico. *Geological Society of America Bulletin*, 81, 241-246.

Study area: Northern Gulf of Mexico.

Methodology: Historical charts, maps, air photos.
Comments: Lateral barrier migration in the direction of the predominant littoral drift (westward) has dominated these islands with only minor landward movement by comparison. Timbalier Island has migrated 6 km westward (alongshore) and 1.6 km northward (landward) in 69 years. Inlets play a principal role in barrier dynamics; islands become reintegrated from hurricane-fragmented islets.

PIERCE, J.W., 1970. Tidal inlets and washover fans. *Journal of Geology*, 78, 230-234.

Study area: North Carolina coastline.
Methodology: Air photos (qualitative).
Comments: Inlets can be formed by (1) direct attack of ocean waves or (2) breaking out of dammed waters from lagoon. Overwash surges can cut inlets if (1) overtopping is allowed, (2) barrier is narrow, (3) adjacent lagoon is relatively deep. Inlets often occur at location of tidal creeks or channels in the marsh. Inlets have been reopened or rejuvenated at same place along the barrier. Northeast storms largely result in washovers with few inlets due to relatively low storm surge and low velocity offshore wind following onshore wind. Hurricanes with strong offshore winds following onshore winds often cut many inlets from bayside. Prior lowering of dune ridge elevations by overtopping waves facilitates inlet cutting from bayside surge.

PIERCE, J.W. and COLQUHOUN, D.J., 1970. Holocene evolution of a portion of the North Carolina coast. *Geological Society of America Bulletin*, 81, 3697-3714.

Study area: North Carolina Outer Banks.
Methodology: 51 augered (bore) holes; Coastal and Geodetic Survey charts (qualitative).
Comments: Sixty-one percent of barrier lies over lagoonal or inlet fill sediments; 39% of barrier rests on top of Pleistocene sediments. Holocene barrier may have stabilized along trend of Pleistocene barrier. Continued evolution with sea level rise will lead to destruction of all barriers (subaerial Holocene and underlying Pleistocene structures) by driving them onto the mainland.

WRIGHT, L.D.; SWAYE, F.J., and COLEMAN, J.M., 1970. Effects of Hurricane Camille on the landscape of the Breton-Chandeleur Island chain and the eastern portion of the lower Mississippi delta. *Louisiana State University, Coastal Studies Institute, Technical Report 76*, 34p.

Study area: Mississippi delta.
Methodology: Aerial and ground observations.
Comments: Hurricane Camille almost leveled Breton Island; large quantity of sediment was lost offshore by ebb surge currents following hurricane. Gosier Island was completely destroyed (drowned) by Hurricane Camille. Small volume of sandy materials in barrier's sediments favors its obliteration during storm. Most of the beach sand was transported to bay as overwash or inlet deposits.

EL-ASHRY, M.T., 1971. Causes of recent increased erosion along United States shorelines. *Geological Society of America Bulletin*, 82, 2033-2038.

Study area: U.S. coast.
Methodology: Historical air photos (qualitative).
Comment: Increased shoreline erosion in descending order due to: (1) increase in storminess, (2) recent eustatic rise in sea level (2-5 mm/yr) and application of Bruun Rule (ratio of 1:100, vertical rise to horizontal retreat), (3) human interference in coastal processes (of local importance only).

KRAFT, J.C., 1971. Sedimentary environment, facies pattern, and geologic history of a Holocene marine transgression. *Geological Society of America Bulletin*, 82, 2131-2158.

Study area: Delaware.
Methodology: 80 shallow cores; 30 deep drill holes.
Comments: Barriers are moving landward and upwards in space and time with sea level rise and concurrent coastal transgression. Overwash sediments are generally found above salt marshes which in turn were principally established on flood tidal deltas. Estuarine barrier beaches retreat landward chiefly by overwash (inlet dynamics is precluded because movement is across the mainland). Sand sources for barriers believed to be (1) the shallow marine shelf in the nearshore area, and (2) eroding Pleistocene headlands.

DOLAN, R., 1972. Barrier dune system along the Outer Banks of North Carolina: a reappraisal. *Science*, 172, 286-288.

Study area: Cape Hatteras, North Carolina.
Methodology: Beach width changes on historical air photos.
Comments: Building high barrier dunes is believed to be detrimental to the long term stability of barrier islands. Dunes are a response element rather than a forcing function. Barrier dunes are believed to constrict the swash zone during storms, forcing the entire system out of equilibrium (sic). Swash constriction predicted to result in greater energy dissipation per unit length of beach. Finer sediments (0.25 mm) would be lost due to attrition and winnowing, leading to a coarsening of beach sand and steeper beach slope. Accelerated erosion would then result from increased wave reflection from the steeper beach. Stabilized dunes are believed to be in an "inactive state" and not a part of the dynamic barrier system.

HARRISON, S.L., 1972. The sediments and sedimentary processes of the Holocene tidal flat complex, Delmarva Peninsula, Virginia. *Louisiana State University, Coastal Studies Institute, Technical Report 112.*

Study area: Virginia barrier islands.
Methodology: Field observations, coastal charts.
Comments: Large infusions of sediment occur through ephemeral inlets, resulting in bay sedimentation. Tidal flats (flood tidal deltas) extend 2 km landward of healed or temporary inlets. New salt marshes are now developing on these inlet deposits. Temporary, storm-cut inlets are most effective in landward barrier migration with overwash occurring locally at low areas, such as sites of inlets. Overwash occurs several times a year along these low barrier islands, but depositional thicknesses are quite low (several inches).

McCANN, S.B., 1972. Reconnaissance survey of Hog Island, Prince Edward Island. *Maritime Sediments*, 8, 107-113.

Study area: Prince Edward Island, Canada.
Methodology: Historical air photos (qualitative).
Comments: Large washover fans are located in areas of infilled inlets. Marsh development occurs in protected areas and is associated with spit growth (ridge and swale topography) or inlet dynamics (flood tidal deltas).

DOLAN, R.; GODFREY, P.J., and ODUM, W.E., 1973. Man's impact on the barrier islands of North Carolina. *American Scientist*, 61, 152-162.

Study area: Outer Banks, North Carolina.
Methodology: Observations, vegetative transects.
Comments: Barrier islands are in a state of dynamic equilibrium and change is essential to the maintenance of natural ecosystems. Natural barrier islands are characterized by a wide beach backshore, low dunes, overwash flats and scattered shrubs (Core Banks). Artificially stabilized barriers have narrow beaches, vertically scarped, high dunes, and shrub thickets/maritime forests (Hatteras Island). Outer Banks of North Carolina were believed to be naturally sparsely vegetated and overwash dominated except at a few broader "spots" such as Buxton. Overwash is believed to be the dominant process in island maintenance and salt marsh creation with rising sea level. Stabilized dunes have resulted in a situation where high wave energy is concentrated in an increasingly restricted run-up area, resulting in a steeper beach profile, increased turbulence, and a tendency for the beach sand to be broken up into finer pieces and washed away. Stabilized barrier dunes prevent overwash and limit salt spray, resulting in ecological succession from grasses to woody vegetation. Artificial stability has turned a dynamic stable ecosytem into one which could be destroyed with major storm breaching of the man-made dune.

GODFREY, P.J. and GODFREY, M.M., 1973. Comparisons of ecological and geomorphic interactions between an altered and unaltered barrier island system in North Carolina. *In:* D.R. Coates, (ed.), *Coastal Geomorphology*. Binghampton, New York: State University of New York, 239-258.

Study area: Outer Banks, North Carolina.
Methodology: Observations and vegetative surveys.
Comments: Presence of grasslands (particularly *S. patens*) makes overwash a constructive rather than an erosive force on barrier islands. Dunes prevent overwash from becoming too frequent or severe so that vegetative recovery can occur between major storms. Barrier dune stabilization results in accelerated ecological succession towards species less tolerant of salt water flooding and sand burial. When long-stabilized dunes are breached by overwash surges, there could be a major ecological perturbation due to lack of plant recovery.

KRAFT, J.C.; BIGGS, R.B., and HALSEY, S.D., 1973. Morphology and vertical sedimentary sequence models in Holocene transgressive barrier systems. *In:* D.R. Coates, (ed.), *Coastal Geomorphology.* Binghamton, New York: State University of New York, 321-354.

Study area: Delmarva Peninsula.
Methodology: Shallow cores and deep augers.
Comments: The typical barrier island sequence from bottom to top is lagoon, tidal delta, salt marsh, washover, and dune. This stratigraphic relationship suggests that overwash follows inlets and marshes develop primarily on inlet deposits. Extensive marshes are associated with present day or historical inlets.

KUMAR, N., 1973. Modern and ancient barrier sediments: new interpretations based on stratal sequences in inlet-filling sands and on recognition of near-shore storm deposits. *Annals of the New York Academy of Sciences,* 222, 245-340.

Study area: South shore of Long Island, New York.
Methodology: Box cores, vibracores.
Comments: Submergence of barriers can result in 4 different histories: (1) barrier migrates landward, (2) barrier thickens in place and/or progrades seaward, (3) barrier is drowned in place and new barrier develops at a higher level landward, (4) barrier is washed away. Location of ancient Holocene barrier islands on the shelf can be identified by seismic studies as a lens of inlet-filling sands deposited by a laterally-migrating tidal inlet. These sediments would have a distinguishable signature in contrast to the adjacent, nearly horizontally-laminated layers. Continuous landward barrier migration should leave a "blanket" of inlet-filling sands on the shelf. Best evidence for landward migration of barriers is exposure of lagoonal sediments on seaward side of barrier. Actual mode of landward migration of barriers (overwash vs. inlets) is not known for this area.

MEHTA, A.J. and BROOKS, H.K., 1973. Mosquito lagoon barrier beach study. *Shore and Beach* 51, 27-34.

Study area: Cape Canaveral, Florida.
Methodology: Observations; previous studies.
Comments: False Cape is a promontory because of resistant older beach deposits outcropping in surf zone. Pleistocene deposits on shelf have slowed or halted barrier retreat in this vicinity due to (1) consolidated nature of material—somewhat more resistany to erosion, and/or (2) sufficient supply of sand from erosion of these pre-Holocene sediments.

MORTON, R.A. and DONALDSON, A.C., 1973. Sediment distribution and evolution of tidal deltas along a tide-dominated shoreline, Wachapreague, Virginia. *Sedimentary Geology,* 10, 285-299.

Study area: Wachapreague, Virginia.
Methodology: 18 borings.
Comments: Major inlets have been relatively stable through Holocene time and appear to be located in ancient (Pleistocene) stream valleys. Salt marshes have developed primarily upon the flood tidal deltas associated with the major, relatively permanent inlets; marsh creation by ephemeral inlets and overwash is minor by comparison.

GODFREY, P.J. and GODFREY, M.M., 1974. The role of overwash and inlet dynamics in the formation of salt marshes on North Carolina barrier islands. *In:* R.A. Reimold, (ed.), *Ecology of Halophytes.* New York: Academic Press, 407-427.

Study area: Core Banks, North Carolina.
Methodology: Historical air photos and charts (qualitative); vegetative profiles, and shallow cores.
Comments: Vertical sequence of upper 10 feet of barrier consists of repetitive layers of overwash sand and salt marsh material. New salt marshes of *Spartina alterniflora* are more than twice as productive as older marshes (1.9:0.7 kg/m^2). Old marshes often have higher surfaces and bayside erosional scarps so that tidal flooding is not frequent and less detritus reaches the estuary compared to low, sloping surface of new marshes. Most marshes appear to be related in some way to the location of former inlets and their flood tidal deltas. Marshes are eventually connected to barrier nucleus by overwash, significantly widening the narrow subaerial barrier. Overwash and inlet dynamics result in the landward migration (rollover) and maintenance of a low barrier island with sea level rise.

SHORT, A.D.; COLEMAN, J.M., and WRIGHT, L.D., 1974. Beach dynamics and nearshore morphology of the Beaufort Sea coast, Alaska. *In*: J.C. Reed and J.E. Sater, (eds.), *The Coast and Shelf of the Beaufort Sea.* Arlington, Virginia: Arctic Institute of North America, 477-488.

Study area: Beaufort coast, Alaska.
Methodology: Field and aerial observations.
Comments: Barrier islands are migrating westward (laterally) at rates of 6-25 meters per year. This migrational pattern affects the island width, inlet locations, and beach morphology.

U.S. ARMY COASTAL ENGINEERING RESEARCH CENTER, 1977. *Shore Protection Manual.* Washington, D.C.: U.S. Army Corps of Engineers, 3 Vols.

Study area: U.S. coastline.
Methodology: Published reports.
Comments: Overwash is limited to low barrier islands and accounts for less than 1 yd^3/yr/ft of shoreline. Overwash is probably important in barrier island migration within a geologic time frame, but most coastal engineering projects are based on a useful life of 100 years or less. In such a short time period, geologic processes of sea level rise are viewed as minor compared to seasonal and storm-induced changes. Current trends in sea level may not be indicative of future fluctuations. There is no real evidence that dunes accelerate beach erosion as suggested by Dolan (1972).

ARMON, J.W., 1975. The dynamics of barrier island chain, Prince Edward Island, Canada. McMaster University, Canada, Ph.D. Dissertation, 546p.

Study area: Malpeque Island, Canada.
Methodology: Field survey profiles, historic air photos (quantitative).
Comments: Ninety-four percent of landward sediment transfers are associated with presence of inlets. Overwash prominent only at inlet margins; elsewhere substantial dunes are present. Wider portions of the island indicate the locations of former inlets. Quantity of sand in supratidal barrier has been maintained with landward retreat over 33 yr period. Malpeque barrier, characterized by narrow foreshores and high backing dunes, is in natural equilibrium.

GODFREY, P.J. and GODFREY, M.M., 1975. Some estuarine consequences of barrier island stabilization. *In*: L.E. Cronin, (ed.), *Estuarine Research, Vol. 2*. New York: Academic Press, 485-516.

Study area: Outer Banks, North Carolina.
Methodology: Vegetation and topographic transects.
Comments: Backbarrier salt marshes are primarily the result of inlet dynamics with overwash being of secondary importance. Salt marshes can be divided into three categories: (1) young, (2) mature, and (3) old. The primary distinction between these groups is width of the low marsh zone, with old and mature marshes being very narrow fringes along the bayshore. Marshes near inlets are the most productive and have the best flushing— thereby providing the most nutrients to the estuarine system. Inlet and overwash-created marshes are characterized by a gradual slope, expanding margins, and high overall productivity. Old marshes often display pronounced eroding scarp edges and ecological succession is allowing for invasion and replacement by more upland (terrestrial) species at the expense of *Spartina alterniflora*. Marshes seem to reach maturity in 20-30 years which indicates a time scale for marsh rejuvenation if high overall productivity is to be maintained; this concept was translated into a general marsh succession cycle. Long-term stability, either natural or artificial, will lead to marsh senescence in accord with ecological principles. Dunes can be helpful by preventing excessive or frequent overwash so that vegetative recovery can occur, but long-term stability is viewed as detrimental to the overall health of the marsh-estuarine system. Where human development has progressed and landward barrier retreat is controlled, artificial marshes can be built to simulate natural processes.

MATHEWSON, C.C.; CLARY, J.H., and STINSON, J.E., 1975. Dynamic physical processes on a south Texas barrier island — impact on construction and maintenance. *Institute of Electrical and Electronics Engineers, Ocean*, 75, 327-330.

Study area: Padre Island, Texas.
Methodology: Observations.
Comments: Hurricane breaching of foredune ridge results in washovers. Prevailing onshore wind moves large quantities of beach sand through the dune breach. Finally, dune repair is com-

plete and the large dune form moves landward across the barier, resulting in large-scale back-barrier accretion and ultimately barrier migration.

McGOWEN, J.H. and SCOTT, A.J., 1975. Hurricanes as geologic agents. *In*: L.E. Cronin, (ed.), *Estuarine Research*. New York: Academic Press, 23-46.

Study area: Texas coastline.
Methodology: Observations.
Comments: Overwash activity depends upon (1) density of vegetation, (2) degree of foredune development, (3) width of barrier. Subaerial overwash sands are redistributed by aeolian processes. Washover deposits in south Texas are thin (few inches to 1 ft), sheet-like, and extend 1,400-5,200 ft inland.

SANDERS, J.E. and KUMAR, N., 1975. Evidence of shoreface retreat and in place "drowning" during Holocene submergence of barriers, shelf off Fire Island, N.Y. *Geological Society of America Bulletin*, 86, 65-76.

Study area: Fire Island, New York.
Methodology: Shallow vibracores and seismic surveys on shelf.
Comments: Two hypotheses for barrier retreat during transgression: (1) shoreface retreat — barriers migrate continuously landward and (2) in-place drowning. Eventually barrier will drown and new barrier will form along landward edge of former lagoon. If a barrier drowns in place, inlet-filling sands should form only narrow, linear lenses parallel to shore at the position of the drowned barrier. Relict Fire Island was believed to be formed 7 km seaward and -24 m below present barrier. Barrier overstepping hypothetically occurred 7,500 yr BP when barrier jumped 5 km landward and was -16 m below present level. Fire Island has migrated continuously landward since this time.

SCHWARTZ, R.K., 1975. Nature and genesis of some storm washover deposits. *United States Army Coastal Engineering Research Center, Technical Memorandum No. 61*, 70p.

Study area: North Carolina.
Methodology: Field surveys and observations.
Comments: Overwash occurrence is a function of (1) storm surge height and (2) backshore/foredune relief. Major sources of washover sediment are the beach and shoreface; foredunes and offshore areas may contribute variable amounts. February 1973 northeaster at North Carolina resulted in an average of 2.7 m^3/m of overwash for 112 km of shoreline, with a maximum overwash deposition of 44.3 m^3/m at Buxton, North Carolina. There is little quantitative data to indicate the relationship between washover volumes and subaerial sediment budget of a barrier island. Waves may be reflected from eroding seaward face of high foredunes during major storms.

SWIFT, D.J.P., 1975. Barrier island genesis: evidence from the central Atlantic shelf, Eastern U.S.A. *Sedimentary Geology*, 14, 1-43.

Study area: Mid-Atlantic east coast shelf.
Methodology: Coastal charts and maps (qualitative).
Comments: Small, rock-tied transgressive spits have been overstepped or drowned. Barrier sand budget is dependent upon shelf/coastal plain slope; (1) gentle slopes — shoreface erosion penetrates pre-recent substrate for barrier nourishment and (2) steep slopes — shoreface erosion does not extend below recent lagoonal deposits; retreat must accelerate or barrier will be overstepped (drowned). With abundant sand supplies, barrier will experience standstill with upward growth as sea level rises. The wave beveler will form a shelf scarp and a prism of shoreface sediments will be preserved (not reworked) on the shelf, but continuous barrier retreat will occur with onset of migration. Late Holocene (4,000-7,000 BP) reduction in rate of sea level rise may have resulted in standstill with upward barrier growth.

WILKINSON, B.H., 1975. Matagorda Island, Texas: the evolution of a Gulf coast barrier complex. *Geological Society of America Bulletin*, 86, 959-967.

Study area: Matagorda Island, Texas.
Methodology: Augered holes; charts, maps, air photos (qualitative).
Comments: Matagorda Island has prograded seaward 4.8 km under conditions of stable sea level during the last few thousand years. Sediment sources: (1) shelf and (2) rivers. Extensive salt marshes have formed on flood tidal delta sediments. Significant volume of island consists

of flood tidal delta sediments (importance of inlets).

BARTBERGER, C.E., 1976. Sediment sources and sedimentation rates, Chincoteague Bay, Maryland and Virginia. *Journal of Sedimentary Petrology*, 46, 326-336.

Study area: Assateague Island, Virginia – Maryland.
Methodology: Cores in Chincoteague Bay.
Comments: Present average rate of sedimentation of Chincoteague Bay is 0.3 mm/yr; this amount of accretion will not keep pace with sea level rise (2-5 mm/yr). Present anomalously low sedimentation rate and accompanying decline in salt marsh growth is due to natural closure of former tidal inlets through Assateague Island. Dune stabilization may be unwise because overwash is believed to be the major means of landward barrier migration at present. Average sedimentation of Chincoteague Bay during past 5,000 years has been 1.5 mm/yr.

FIELD, M.E. and DUANE, D.B., 1976. Post Pleistocene history of the U.S. inner continental shelf: significance to origin of barrier islands. *Geological Society of America Bulletin*, 87, 691-702.

Study area: Atlantic east coast.
Methodology: Seismic profiles and deep vibracores on shelf.
Comment: Detachment of linear, shoreface-connected shoals probably represents a net loss of sand to a landward-retreating barrier island. Some modern (Holocene) barriers have Pleistocene cores, but barriers will not be "hung up" as long as a topographically lower surface (such as a bay) exists to the landward, barriers will migrate upslope as an island with sea level rise. Slope of the coastal plain controls pattern of barrier migration: (1) gentle slope — lagoon will widen while barrier builds mostly upward with slow landward migration and (2) steep slope — barrier welded onto mainland.

LEATHERMAN, S.P., 1976. Barrier island dynamics: overwash processes and eolian transport. *Proceedings of the 15th Coastal Engineering Conference*. New York: American Society of Civil Engineers, 1958-1974.

Study area: Assateague Island.
Methodology: Field surveys and storm measurements (quantitative).
Comments: Sediment budget approach was used to monitor amounts of sediment transport at washover fans. Limiting criterion for overwash at Assateague was a deep water wave height of 11 feet. Storm surge and barrier threshold elevation are the two most important parameters in determining the magnitude of an overwash event. Chief sources of sand for overwash surges are the beach backshore and barrier dunes. Overwash deposition was equalled by eolian deflation so that there was little net change on the fan surface. Washover fans/flats serve as temporary reservoirs for eventual redistribution of the sand; prevailing northwest (offshore) winds blow much of the overwash sand back to the beach.

FISHER, J.J., 1977. Relict inlet features of the Currituck inlets. *In*: V. Goldsmith, (ed.), *Coastal Processes and Resulting Forms of Sedimentary Accumulation Currituck Spit, Virginia/North Carolina*. Virginia Institute of Marine Science, SRAMSOE, No. 143, 93-104.

Study area: North Carolina Outer Banks.
Methodology: Maps, charts, historical air photos.
Comments: Historic inlets have occurred along 15% of the Outer Banks, a microtidal barrier. Relict inlet features indicate that historic and pre-historic inlets have occurred over 35% of the Outer Banks.

FISHER, J.S. and STAUBLE, D.K., 1977. Impact of Hurricane Belle on Assateague Island washover. *Geology*, 5, 765-768.

Study area: Assateague Island, Maryland.
Methodology: Field surveys.
Comments: Overwash of less than major proportions is not a significant process for landward barrier migration. Hurricane Belle (1976) resulted in 19 m^3/m of overwash deposition, but all of this material was transported back to the beach within 6 months. For some small winter northeasters, more sand was transported offshore by the wind than deposited by overwash.

HOSIER, P.E. and CLEARY, W.J., 1977. Cyclic geomorphic patterns of washover on a barrier island in southeast North Carolina. *Environmental Geology*, 2, 23-31.

Study area: Masonboro Island, southeastern North Carolina.
Methodology: Physiographic-vegetational transects and historical air photos (qualitative).
Comments: Overwash is a temporally and spatially sporadic phenomenon; the island exhibits a degree of recovery between storms. Largest expanse of salt marsh has developed on flood tidal delta deposits. Overwash results in net widening of island, but width averages less than 550 feet. Significant shoreline erosion is associated with extensive overwashes. Dune growth following overwash is rapid and continuous, and fairly high dunes soon develop along the island with overwash occurring only during infrequent, severe storms. Overwash is a dominant process on Masonboro Island and viewed as the mechanism by which the island maintains its integrity with landward retreat and sea level rise. Areas most vulnerable for human development are sites adjacent to inlets or old inlet areas. Dune plantings and snow fencing can be used to speed up the natural pattern of post-overwash recovery.

LEATHERMAN, S.P.; WILLIAMS, A.T., and FISHER, J.S., 1977. Overwash sedimentation associated with a large-scale northeaster. *Marine Geology*, 24, 109-121.

Study area: Assateague Island, Maryland.
Methodology: Field surveys (quantitative).
Comments: December 1, 1974 northeaster resulted in 20 m^3 of overwash per meter of dune breach. During small winter northeasters, overwash occurs primarily at existing dune breaches and lasts for several hours bracketing high tide. Large-scale northeasters and hurricanes can have a large impact in terms of subaerial sediment transport (overwash) on low-lying barrier islands.

FISHER, J.S. and STAUBLE, D.K., 1978. Washover and dune interaction on a barrier island. *Proceedings of Coastal Zone '78*. New York: American Society of Civil Engineers, 1611-1618.

Study area: Assateague Island, Maryland.
Methodology: Field surveys (quantitative).
Comments: Inlets are viewed as primary means of barrier migration within a geologic time frame. Large-scale storms will destroy foredunes, resulting in overwash; therefore, foredune maintenance has little effect on net volume of sand transported across the island. Small-scale overwash events do not permanently displace sediment landward and thus have little contribution to total sand volume of barrier. Dune maintenance and repair can be undertaken without adverse consequences to the island's sand budget.

HERBERT, J.R.; HERON, D., and MOSLOW, T.F., 1978. Interactions between microtidal barriers and flood tidal deltas. *Geological Society of America Annual Meeting* (abstract), 419.

Study area: Ocracoke Island, North Carolina.
Methodology: Deep auger holes and historical maps and charts (qualitative).
Comments: Microtidal barriers can widen soundward by incorporation of flood tidal delta into island nucleus. Overwash sand, deposited on top of these tidal delta sediments, can then increase the barrier elevation.

MAURMEYER, E., 1978. Geomorphology and evolution of transgressive estuarine washover barriers along the western shore of Delaware Bay, Newark, Delaware. University of Delaware, Ph.D. dissertation, 274p.

Study area: Western shore of Delaware Bay, Delaware.
Methodology: Field surveys, historical shoreline analysis (quantitative).
Comments: Estuarine washover barriers are migrating upward (vertical accretion) and landward with sea level rise. General increase in barrier dimensions southward along Delaware Bay is directly related to increased sediment supply and high wave energy. Texture of barrier sediments reflects (1) energy conditions and (2) source area. Two most important parameters in controlling barrier susceptibility to overwash are (1) storm tide level and (2) barrier elevation. Field studies showed that only a small proportion (6-21%) of barrier sand is transported landward by overwash with most of the sand being lost offshore; therefore, overwash does not represent a conservation of mass process. Without significant new supplies of sand by littoral drift from headlands or from riverine sources, barriers will diminish in volume and eventually disappear with sea level rise and barrier transgression. According to the Bruun Rule, a barrier will eventually consume itself in the absence of new sediment input.

RAMPINO, M., 1978. Quaternary history of south central Long Island, New York. New York: Columbia University, Ph.D. dissertation, 750p.

Study area: Long Island, New York.
Methodology: 400 boreholes, cores, marsh probings, offshore vibracores, and seismic reflection/ bathymetric profiles on inner shelf.
Comments: Relative sea level rose 25 cm/100 yrs between 7,000-3,000 BP. Rate slowed markedly to 10 cm/100 yrs during last 3,000 years, which allowed for initiation of present backbarrier salt marshes. Extensive preservation of 7,000-8,000 BP backbarrier sediments on inner shelf suggests that barriers underwent discontinuous retreat by in-place "drowning" and jumping of surf zone landward. When the sea reached -15 m MSL, barriers were overstepped by rapidly rising sea and surf zone skipped landward to a position 2 km offshore of present shoreline. Rapid sea level rise and low sand supply seem to favor barrier drowning. Large marshy areas represent former flood tidal deltas. It is estimated that 40% of barrier island is underlain by inlet-filling sediment. Two theories of barrier island migration: (a) shoreface retreat — barriers migrate continuously landward (Swift, 1968, 1975), (b) in-place drowning — barriers grow upward and are later overstepped (Sanders and Kumar, 1975). With shoreface retreat or barrier jumping, new barrier shoreline would form at and be welded to an old Pleistocene barrier ridge (superconstruction stage). However, sea level rise would continue to push barrier system landward so that Holocene barrier would not actually be "hung-up" on Pleistocene high. Erosion of Pleistocene sediments may supply large quantities of sand and hence slow down the rate of landward migration of Holocene barrier, or if these old sediments of Pleistocene barrier are somewhat consolidated, act to partially shield the present barrier once left exposed on the shelf.

ARMON, J.W., 1979. Landward sediment transfers in a transgressive barrier island system, Canada. *In:* S.P. Leatherman, (ed.), *Barrier Islands*. New York: Academic Press, 65-80.

Study area: Malpeque barrier, Gulf of St. Lawrence, Canada.
Methodology: Field surveys and historical air photo analysis (quantitative).
Comments: Ninety percent of backbarrier sedimentation during 33 year period (1935-1968) occurred at existing or closed inlets; of this total, 40% was associated with temporary inlets. Volumetric data suggest that tidal inlets play the dominant role in landward barrier migration during transgression; other processes (overwash and aeolian) transport relatively small proportions of sand landward. Flood tidal delta deposition by inlets was minimized due to the microtidal regime, small lagoonal areas, and correspondingly small inlet channels, as well as shallow bedrock channel bottom (depth limitation). However, tidal inlets produce the wider zones of the transgressive barrier islands. Thirty-five percent of Malpeque barrier has been influenced by inlets in last 210 years. Restricted storm activity and rapid dune growth with vigorous vegetation severely limits overwash and aeolian action, except at inlet-related localities.

ARMON, J.W. and McCANN, S.B., 1979. Morphology and landward sediment transfers in a transgressive barrier island system, southern Gulf of St. Lawrence, Canada. *Marine Geology*, 31, 333-344.

Study area: Malpeque Island, Canada.
Methodology: Air photo analysis (quantitative).
Comments: Barrier widths of 150-200 meters are common; inlets, by means of construction of their flood tidal deltas, can extend barrier landward by 5 times their width and account for over 90% of landward sediment transfers. Overwash along this coast is greatly restricted, while temporary tidal inlets play an essential role in island migration. Aeolian sand transport across the dunes occurs only on a very local scale at blowouts. This barrier is characterized by narrow, high dune shoreline, which is in equilibrium for this retreating barrier.

CLEARY, W.J. and HOSIER, P.E., 1979. Geomorphology, washover history, and inlet zonation: Cape Lookout, North Carolina to Bird Island, North Carolina. *In:* S.P. Leatherman, (ed.), *Barrier Islands*. New York: Academic Press, 237-272.

Study area: Southeastern North Carolina.
Methodology: Field surveys, historical air photos and maps (qualitative).
Comments: Geomorphic and historic evidence indicated that 56% of the coastline is underlain by inlet fill. Coarse-grained sandy beaches exhibit

slow recovery after overwash and little dune regrowth compared to fine-grained sandy barriers. Past washover areas are highly susceptible to future washovers.

CLEARY, W.J.; HOSIER, P.E. , and WELLS, G.R., 1979. Genesis and significance of marsh islands within southeastern North Carolina lagoons. *Journal of Sedimentary Petrology*, 49, 703-710.

Study area: Southeastern North Carolina.
Methodology: Historical maps, charts, and air photos.
Comments: Presence of marsh islands in the lagoon adjacent to barrier indicates former inlet activity. Marsh islands are remnants of old flood tidal deltas. Distribution of marsh islands is related to inlet migration and proximity to flood tidal delta. Marsh islands represent a major sink of sediments and means of landward barrier migration.

FISHER, J.J. and SIMPSON, E.J., 1979. Washover and tidal sedimentation factors in development of a transgressive barrier shoreline. *In:* S.P. Leatherman, (ed.), *Barrier Islands*. New York: Academic Press, 127-149.

Study area: Rhode Island.
Methodology: Historical air photo analysis (quantitative).
Comments: During 36-year period, tidal delta sedimentation is 133% more effective than washover in landward transport. Overwash processes are most effective in supratidal (vertical) accretion. Beach erosion is directly related to overwash occurrence along this 40-km shoreline. Most of the sand lost from the beach face with barrier transgression is lost offshore in accordance with Bruun Rule; the remainder is displaced landward as overwash and inlet deposits.

GODFREY, P.J.; LEATHERMAN, S.P., and ZAREMBA, R., 1979. A geobotanical approach to classification of barrier beach systems. *In*: S.P. Leatherman, (ed.), *Barrier Islands*. New York: Academic Press, 99-126.

Study area: Nauset Spit, Massachusetts; Cape Lookout, North Carolina.
Methodology: Shallow cores, elevational and vegetative transects.
Comments: Northern barrier beaches are dominated by American beach grass, which is very vigorous and tends to build continuous, high barrier dunes where possible. Southern (North Carolina) barrier dunes are colonized primarily by sea oats and salt meadow grasses; dunes tend to be lower and discontinuous. Northern barrier marshes are colonized by the decumbent form of high salt marsh cordgrass (*Spartina patens*) which is killed when significantly buried; recovery occurs primarily by drift line plants. Southern salt marshes are also colonized by this plant, but this upright variety can grow vertically through large deposits of sand (75 cm) within a single year. It is concluded that the geomorphic development of barrier islands is greatly influenced by the type of vegetation, which explains part of the regional differences in barrier island morphology. For example, northern barriers consist largely of dune and salt marsh components with little real barrier flat; whereas North Carolina barriers often have very wide, low flat areas between the dunes and marsh/bay. In both the northeast and southeast, overwash creates the basal surface on which dunes form. Typically, overwash sediments are deposited on top of salt marshes, which have often developed on old flood tidal deltas. Frequency of overwash in the southeast tends to be much greater than in the northeast, partially in response to better dune development and higher tidal ranges in the northeast. Conceptual models for overwash response in the two contrasting areas were portrayed by block diagrams; thus, barrier beaches can be classified, in part, according to their ecological characteristics.

LEATHERMAN, S.P., 1979a. Migration of Assateague Island, Maryland, by inlet and overwash processes. *Geology*, 7, 104-107.

Study area: Assateague Island, Maryland.
Methodology: Historical air photo analysis (quantitative).
Comments: Air photo analysis showed that the greatest island widths and highest rates of landward migration are associated with inlet dynamics (particularly ephemeral and migrating inlets). Overwash at maximum transport rates is only effective in maintaining the island as a low, narrow barrier. Large bayside protuberances were associated with temporary inlets and construction of their flood tidal deltas. Overwash is

effective in maintaining the island width between the limits of 400-700 feet at Assateague. Lateral growth of a transgressive barrier is controlled largely by inlet dynamics. Vertical buildup of island is governed by interaction between overwash-aeolian processes and plant communities. Dune establishment is necessary to slow down the overwash process and allow for vertical accretion of sediments.

LEATHERMAN, S.P., 1979b. Barrier dune systems, a reassessment. *Sedimentary Geology*, 24, 1-16.

Study area: Assateague Island, Maryland.
Methodology: Field surveys and historical air photo analysis (quantitative).
Comments: Barrier dunes are an important and natural part of most migrating barrier island systems. Barrier dunes are not believed to affect the long-term geologic process of landward barrier migration with a rising sea level. Barrier dynamics correspond to large-scale displacements of sediment with time scale of tens to hundreds of years; short pulses of energy from 50-100 year storms accomplish the major portion of the geologic work at Assateague Island. Inlets, through construction of large flood tidal deltas, result in the majority of landward (horizontal) migration of retreating barriers. Overwash is only effective in maintaining the island as a low, barren barrier, unless dunes are allowed to develop so that vertical accretion can occur. Dolan's (1972) contention that dunes force the entire system out of equilibrium and result in increased beach erosion thus appears incorrect. Storm measurements and observations showed that the beach profile was flattened by the high energy waves, rather than steepening as proposed by Dolan. At the peak of the storm, waves may be reflected from the eroding, vertical dune face, but wave tank tests show that the majority of wave reflection is from the seaward face of the outer storm bar. Dunes, natural or artificial, are a part of the dynamic barrier system. Dunes help to slow shore recession by serving as a stockpile of sand rather than increasing the rate of beach erosion. Barrier dune construction encourages development by offering a false sense of protection. With incessant shore erosion, dune destruction and overwash/inlet processes will result without intervention by costly, stop-gap engineering projects.

LEATHERMAN, S.P., 1979c. Beach and dune interactions during storm conditions. *Quarterly Journal of Engineering Geology*, 12, 281-290.

Study area: Assateague Island, Maryland and Nauset Spit, Massachusetts.
Methodology: Field measurements and observations.
Comments: Field measurements and observations during two major storms showed that beach slope and sand size were not affected by an adjacent eroding dune as suggested by Dolan (1972). There was no indication of "swash constriction," and thus, dunes could not be shown to cause accelerated beach erosion on this basis. Dunes may serve as wave reflectors during major storms, but wave tank tests indicated that this is probably a minimal factor. Dunes play at least 3 important roles during storms, functioning as (1) sand reservoirs, (2) energy dissipators, and (3) barriers to storm waves and swash. Dunes cannot serve as a reliable means of backbarrier protection along an eroding shoreline because inlet and overwash processes will eventually occur in this situation. February 1978 blizzard resulted in 102 m^3/m of overwash transport with penetration distances of 140 m bayward of dune line and depositional thicknesses of 1.7 m above the living salt marsh.

MOSLOW, T.F. and HERON, S.D., 1979. Quaternary evolution of Core Banks, N.C., Cape Lookout to New Drum Inlet. *In:* S.P. Leatherman, (ed.), *Barrier Islands*. New York: Academic Press, 211-237.

Study area: Core Banks, North Carolina.
Methodology: 46 auger and wash-bore holes.
Comments: Between 7,000-4,000 BP, island was migrating landward at rates between 45-98 m per century. Overwash processes apparently dominated. Hydraulically active inlets probably did not exist at this time; inlets were shallow and ephemeral (leaving no discrete channels or sedimentary record). At 4,000 BP, sea level rise slowed appreciably and inlet dynamics and sedimentation dominated the Holocene record. With the infilling and shallowing of Core Sound, there are few active permanent inlets.

OTVOS, E.G., Jr., 1979. Barrier island evolution and history of migration, north-central Gulf coast. *In:* S.P. Leatherman, (ed.), *Barrier Islands*. New

York: Academic Press, 291-320.

Study area: Mississippi-Alabama-Louisiana.
Methodology: Historical air photos; maps and charts; 70 deep cores.
Comments: Comparison of historical maps showed that hurricanes can reduce islands to shoals, but through time new islands could re-emerge in a more landward position through upward aggradation of a broad shoal platform. Upward aggradation of a shoal was shown to be a plausible mechanism for barrier island genesis. Landward barrier migration can be accomplished by (1) overwash, (2) inlets, and (3) post-storm island re-emergence. The emergence of new small islands from shoals has been a common occurrence along the Chandelier Islands.

SUSMAN, K.R. and HERON, S.D., 1979. Evolution of a barrier island, Shackleford Banks, Carteret County, North Carolina. *Geological Society of America Bulletin*, 90, 205-215.

Study area: Shackleford Banks, North Carolina.
Methodology: Deep auger bore holes.
Comments: Much of the island's Holocene sequence represents inlet fills, while overwash sands were largely confined to the upper 1-2 meters of the barrier sequence. Holocene section does not follow Walther's Law due to large-scale erosion by tidal inlets and subsequent infilling. Thus, inlet dynamics probably play the principal role in migration of this barrier.

FRANKS, P.C., 1980. Models of marine transgression — examples from lower Cretaceous fluvial and paralic deposits, north-central Kansas. *Geology*, 8, 56-61.

Study area: Lower Cretaceous sediments of Kansas.
Methodology: Field observations.
Comments: The preserved record of the Kiowa barrier sandstone suggests a mode of barrier retreat with in-place growth, eventual submergence and stepwise, landward shift of the island during transgression.

GUBER, A.L. and SLINGERLAND, R., 1980. Barrier island migration by substrate compaction. *Society of Economic Paleontologists and Mineralogists Annual Meeting (abstract).*

Study area: Virginia barrier islands.
Methodology: Observation and shallow cores.
Comments: Assawoman Island, Virginia, may be retreating landward due to self-induced local subsidence (auto-compaction of underlying marsh sediments).

McCORMICK, C.L. and TOSCANO, M.A., 1980. Origin of barrier island system of Long Island, New York. *Northeast Geological Society of America (abstract)*, 73.

Study area: South shore of Long Island, New York.
Methodology: U.S. Geological Survey quadrangle sheets.
Comments: With sea level rise, barriers must migrate landward and upward, maintaining an equilibrium shoreface profile. Superposition of the low-gradient outwash plain surface and the shoreface profile shows that there is excess sediment; this sand can be quarried and moved onshore by the waves as the barrier moves landward. The shelf is believed to be an important source of sand to the barrier, which would make the Bruun Rule invalid for this area.