Journal of Coastal Research	14	3	867–871	Royal Palm Beach, Florida	Summer 1998

James P. Morgan: Scientific Contributions

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ABSTRACT

COLEMAN, J.M. and STONE, G.W., 1998. James P. Morgan: Scientific Contributions. *Journal of Coastal Research,* 14(3), 867–871. Royal Palm Beach (Florida), ISSN 0749-0208.

Born in southern California in 1919, James Plummer Morgan would emerge from training at Berkeley and Louisiana State University to make several profound contributions in the disciplines of deltaic geology and coastal geomorphology. As an indirect, academic descendant of William Morris Davis through Richard J. Russell, Morgan's mentor at LSU, over half a century of research and student training resulted in Morgan making profound advances in four major areas: (1) loading mechanisms and tectonic roles in controlling the geology and geomorphology of deltaic regions; (2) delta crevassing and subdelta formation; (3) shoreline processes particularly related to coastal erosion and marshland loss; and (4) coastal hazard mitigation. In this paper we summarize the late Dr. Morgan's scientific contributions which have provided a foundation for significant advances in the respective fields and provide a selected list of scientific publications.

ADDITIONAL INDEX WORDS: *James Plummer Morgan; Richard J. Russell; coastal geomorphology; deltaic geology, Louisiana State University; Coastal Studies Institute.*

INTRODUCTION

In 1919, 20th century coastal geomorphology was born with the seminal exposition of Professor D.W. Johnson's text, *Shore Processes and Shoreline Development.* In December of that year, James Plummer Morgan was born in southern California, and as Johnson had done before him, Morgan would emerge in years to come as one of the world's leading scholars in coastal geology and deltaic sedimentation.

After reading in the geological sciences at the University of California, Berkeley, Morgan graduated with a bachelors degree in 1943. During the following three years, he served as an aerial photo interpretations officer with the United States Air Corps. Although he was first exposed to coastal research at Berkeley, it was in the Air Corps that he developed an unparalleled ability to interpret coastal landforms from black and white imagery. And it was perhaps both those traits that drew attention at Louisiana State University in 1946. That year, Morgan began studying towards the doctorate under the tutelage of Professor R.J. Russell, one of the world's leading coastal and fluvial geomorphologists of the time. Russell had been sent to the Gulf Coast from California, by William Morris Davis—the founder of the Davisian school of geomorphology in the United States, to study why the lower Mississippi River was essentially straight, and meandering suddenly ceased. However, Russell could not divorce the importance of the dynamics of the Mississippi River from coastal processes in the Gulf of Mexico, and so the young Morgan was given the task of elucidating the linkages. He received his doctorate from LSU in 1949 and began his professional career under his mentor, Dr. Richard J. Russell. His entire career was devoted to his passion of understanding coastal and delta processes, geology, geomorphology and training students.

Although Dr. Morgan made many individual scientific contributions, his research, along with that of his students, has had a positive impact on several major areas of coastal and deltaic geology and geomorphology. These areas include: (a) loading mechanisms and tectonic roles in controlling the geology and geomorphology of deltaic regions; (b) shoreline processes particularly related to coastal erosion and marshland loss; (c) delta crevassing and subdelta formation and (d) coastal management issues including hurricane damage and prior planning, dune management and data management for coastal resource issues.

LOADING MECHANISMS AND TECTONICS IN DELTA REGIONS

Soon after arriving in Louisiana, Dr. Morgan began working on the "mudlumps" at the mouth of the Mississippi River. Mudlumps had been described and recorded at the mouths of the Mississippi River since the travels of Alvar Nunez Cabeza de Vaca in the 14th century. Sir Charles Lyell described the mudlumps during his visits of 1845 and 1846. Scientific studies of mudlumps did not commence until James B. Eads began construction of the jetties at the mouth of South Pass, in the Mississippi River delta (CORTHELL, 1880). Mud lumps were prohibiting navigation of the river and Eads attempted to discover their origin. HUMPHREYS and ABBOTT (1861) discussed the mudlumps in their publication on the physics and hydraulics of the Mississippi River, but again did little to

98142 received and accepted in revision 9 May 1998.

advance a theory of their origin. Other than the fact that these features blocked river traffic, they remained simply "curious" features of the Mississippi River delta. Many theories have been postulated on their origin, including gas pressure, deposition by waves, subterranean water courses, and many others. It should be mentioned, however, that Abbott (HUMPHREYS and ABBOTT, 1861) stated that it was his opinion that the mudlumps were strongly associated with the dense sands laid down at the mouth of the river. Thus it was not until the early 1950's that a serious research effort conducted by Dr. Morgan commenced on mudlump origin. Working with the Corps of Engineers, he and some of his colleagues began to map the distribution of mudlumps and drill holes in the muddy sediments. Based on these studies, Morgan concluded that these features were indeed the result of differential weighting of the overlying distributary mouth bar sands on the weak underlying prodelta clays. Much more detailed work in 1962 (MORGAN *et al.*, 1963) confirmed this differential weighting theory and added significantly to enhancing the knowledge on the mechanisms, internal structure, dynamic nature, and paleontology. Although Dr. Morgan had concentrated his work solely on the mudlumps, the overall implications of differential weighting of overlying sediments was a major contribution to explaining diapirism (both salt and mud) in the Gulf of Mexico, formation of depocenters by sedimentary loading and compaction and subsidence in river deltas. Immediately after the initial publications on the mudlumps, a large number of publications concerning such factors as mentioned above began to appear in the literature and this initial work resulted in a large number of rapid advances in understanding large-scale sedimentary loading. Morgan published several articles on the Mississippi River mudlumps (1951, 1952, 1961, 1963, and 1968). These papers remain "classics" on the subject of mud diapirs and differential sedimentary loading.

Convinced that differential weighting and structural controls (faulting) played a critical role in the geology and geomorphological landscape in deltas, Morgan and Mcintire proposed working on the Ganges-Brahmaputra River delta in the Bengal Basin of East Pakistan (Bangladesh), one of the world's most extensive deltas. It was their desire to examine the morphology of the delta complex, determine why such a large delta had not prograded seaward over the past 200 years, and to examine the various "older alluvium" in the delta region. The results of this study were published by MORGAN and MCINTIRE in 1956, 1957, and 1959. This research indeed indicated that structural control in rapidly subsiding basins is one of the fundamental processes controlling both the nearsurface geology and geomorphic landscape in deltas. Some of their major conclusions included: (a) terrace surfaces and their surface morphology have been drastically modified by major structural activity; (b) areas of pronounced Recent faulting and folding can be correlated directly with known seismic areas of Assam and adjacent regions; (c) areas within the delta plain (Sylhet Basin) were rapidly sinking, showing in some places subsidence on the order of 12 m within the past few hundred years and were related to movement along a major fault; and (d) much of the delta landscape, especially the river channels and distributaries have a direct link to major faulting in subsiding structural zones associated with a large foredeep region. Today, neotectonics in delta regions is a commonly accepted fact, however, in the early 1950's such research was "cutting-edge".

In our opinion, these two areas of investigation—structural activity and differential weighting in deltas—were instrumental in causing other researchers to question the reasons for some of the dynamic changes being documented in other delta regions. In addition, many of these basic concepts were being extended to much larger, regional aspects of sedimentary weighting and basin tectonics.

SHORELINE PROCESSES AND MARSHLAND LOSS

In the early 1950's, it was becoming clearly apparent that fundamental gaps existed in the understanding of coastal processes. As a partial response, the Office of Naval Research began a systematic research program on coastal processes, an undertaking that was also a reaction to the disasters of naval landings and beach operations during World War II. With ONR funding, Dr. Richard Russell established the Coastal Studies Institute at Louisiana State University in 1952 to respond to this call for coastal research. Dr. Morgan, as Managing Director of the Institute, began to address many of these coastal problems. He and his colleagues first began to examine the Trafficability and Navigability of Louisiana's coastal marshlands. This report was published in 1954 (MORGAN *et al.*, 1954). The results from this initial research were enlightening; it was discovered that little was known concerning coastal and deltaic processes and each field trip resulted in new findings. Morgan and his colleagues began to systematically study these processes when few other earth and ocean scientists were concentrating on the nation's coasts. Their work has been published in far too numerous journals to cite here, but Morgan's papers in the mid 1950's through the 1960's set the stage for much of the more detailed research that followed. It was Dr. Morgan and his students who first documented the high rates of shoreline change along the Louisiana coast (MORGAN *et al.*, 1953; MORGAN and LARIMORE, 1957). Realizing that much of the coastal change was episodic in nature, the monitoring program indicated that much of the erosion of the coastline took place during winter storms and the passage of hurricanes. Some of this information was published towards the end of the 1950's (MORGAN *et al.*, 1958; MORGAN, 1959) and concerned changes in the coastal landscape and damage to the marshlands following hurricanes, particularly hurricane Audrey which made landfall in Louisiana in 1957. These papers are regarded as "classic" in that they were among the first quantitative data sets used to document the hurricane effects on coastal regions (see STONE *et al.*, 1997 for a more detailed review).

Following some of Morgan's early work, research on coastal processes began in earnest and information on coastal processes became a national trend. Research institutions, formally oriented solely towards deep-water studies, began to conduct a significant portion of their research along the coast. Following the initial research in Louisiana, Morgan and Russell initiated an extremely detailed beach process study along the Outer Banks of North Carolina, a coastal marsh study

along the northeast Atlantic coast, and a series of deltaic studies in several foreign deltas and coastlines.

Research along the Louisiana coast, as well as other Gulf Coast states, continued and was carried on primarily by Morgan's students. The result of these works, over nearly a thirty year period, contributed significantly to our understanding of the major coastal processes responsible for shoreline changes and marshland stability. Just prior to retiring from LSU, the impact of Morgan's work on shoreline erosion and marshland loss became apparent; detailed studies of maps and aerial photographs indicated that the shoreline and marshlands of Louisiana were experiencing one of the highest rates of loss in the country. Without the prior studies of he and his students, it would have taken a considerable length of time for the state to realize the loss of one of its most precious resources.

DELTA CREVASSING AND SUBDELTA FORMATION

By the early 1950's, the major processes involving delta formation had been adequately described by RUSSELL (1936), FISK (1947, 1955), and several other co-workers. Realizing that the formation of the bulk of the subaerial marsh deposits of the delta were the result of overbank topping during flooding and breaks in the natural levees that border the main distributaries of the delta channels, Morgan began supervising graduate student research with the overall objective of identifying and elucidating those processes. Their research, under the guidance of Morgan, culminated in detailing the importance of overbank sediment delivery in the filling of interdistributary bays and the formation of delta marshes (VAN LOPIK, 1955; WELDER, 1959). Although these works showed the importance of such processes, few details of the sedimentary architecture, time domains, or magnitude of the processes were evident. In the late 1950's, the State of Louisiana became involved in a lawsuit involving the definition of the shoreline in order to determine the offshore boundary of state water bottoms vs the federal government's claim. Involved in this definition was the role that mudlumps played at the mouths of the major distributaries of the modern Mississippi River. These mudlumps formed offshore from the river mouth passes and from a legal perspective, it became critical to determine the precise mechanisms that formed the mudlumps—were they a product of deltaic sedimentation (land derived) or were they marine in nature and the delta passes simply prograded to these offshore islands? This resulted in an extremely large and detailed study of the mudlump processes (MORGAN *et al.*, 1968). While this study was being carried out, it was discovered that an extremely large, natural mudvent (common on the mudlumps) existed in the delta adjacent to Williams Pass, West Bay. The presence of this mudvent became critical to the lawsuit and to mineral rights of the operating petroleum company (Gulf Oil Company). A large extensive research project was then undertaken by Morgan and a group of his students. This project became known as the West Bay Project and has formed the basis of our understanding of subdelta or bay fill deposits (COLEMAN and GAGLIANO, 1964). Although Dr. Morgan did not publish extensively on the results of this project, his students benefitted from his guidance and planning of the program by simply carrying out his well-conceived project.

POST-LSU YEARS AND "RETIREMENT" IN FLORIDA

Dr. Morgan had spent almost 30 years at LSU and on retirement, he moved to the Florida Panhandle where he accepted a faculty position in earth sciences at the University of West Florida. He played a critical role in establishing the Institute for Coastal and Estuarine Research there in the early 1980's. Although he insisted he had indeed retired, he taught graduate courses in coastal geomorphology and became involved in research on coastal dynamics and management. Morgan's work focussed on assisting the state of Florida in developing and utilizing large data sets on morphological aspects of the state's coast to address shoreline erosion issues, identify potential beach nourishment locations and other coastal problems (MORGAN and STONE, 1983, 1985, 1987; STONE and MORGAN, 1983; STONE *et al.*, 1985). While his focus was now on the applied realm of coastal science, his early training and vast experience with Louisiana's coast and Mississippi River valley allowed him to investigate some of Florida's bayous and bays with emphasis on sedimentation problems and metal contamination in sub-bottom sediments. In less than a 10 year period, he had authored/co-authored near thirty papers/professional reports on coastal related topics in Florida.

Although it is quite easy to document the lasting scientific contributions of Dr. Morgan, it becomes much more difficult to document the influence he had on his students. He instilled in each student the importance of loving the work he/she was undertaking; of being very careful and critical in defining the conclusions of their work; he demanded hard, conscientious work habits and attention to detail, and above all, sharing the results with the scientific community (publishing the results of their work). He took great pride in his students; many times he would share their success with Drs. Russell, Howe, McIntire, and other faculty. In our opinion, if one had asked Dr. Morgan what his most important contribution to the science of coastal and deltaic studies had been, he would have responded: **his students.**

SELECTED SCIENTIFIC PAPERS BY JAMES PLUMMER MORGAN

Morgan, J.P., 1951, Mudlumps at the Mouths of the Mississippi River, 128 pages (Unpublished report for New Orleans District, Corps. Of Engineers).

Morgan, J.P., 1952, Mudlumps at the Mouths of the Mississippi River, Proc. Second Conf. On Coastal Engineering, Houston, TX, pp. 130–144.

Morgan, J.P., Van Lopik, J.R. and Nichols, L.G., 1953, Occurrence and Development of Mudflats Along the Western Louisiana Coast, La. State Univ., Baton Rouge, Coastal Studies Inst., Tech. Rept. No. 2.

Morgan, J.P., et al., 1954, Trafficability and Navigability of the Louisiana Coastal Marshlands, La. State Univ., Baton Rouge, Tech. Report 4.

Morgan, J.P. and Treadwell, R.C., 1954, Cemented Sandstone Slabs of the Chandeleur Islands, Louisiana, J. Sed. Petrol., v. 24, #2, pp. 71–75.

Morgan, J.P. and Wright, M., 1955, A Geographical and Geological

study of the Louisiana Coast with Emphasis Upon Establishment of the Historic Boundary, Rpt. To Att. General, State of Louisiana, CSI Cont. 55-3, 51 p.
Morgan, J.P. and McIntire, W.G., 1956, A Hand Auger for Boring Recent Sediments, Jour. Sedimentary Geology, v. 26, pp. 162–164.
Morgan, J.P. and McIntire, W.G., 1956, Quaternary Geology of the Bengal Basin, Tech. Rept. 9, Coastal Studies Inst. Cont. #56-3.
Morgan, J.P., 1957, Geological Studies of the Bengal Basin, Research Reviews, Off. Naval Research, pp. 1–7.
Morgan, J.P. and Larimore, P.B., 1957, Changes in the Louisiana Shoreline, Tran. Gulf Coast Assoc. Geol. Soc., v. 7, p. 307.
Morgan, J.P., Nichols, L.G. and Wright, M., 1958, Morphological Effects of Hurricane "Audrey" on the Louisiana Coast, La. State Univ., Baton Rouge, Coastal Studies Inst., Tech. Rept. 10.
Morgan, J.P., 1959, Coastal Morphological Changes Resulting from Hurricane "Audrey", Proceedings Salt Marsh Conference, The Marine Institute, U. Georgia, Sapelo Island, Georgia.
Morgan, J.P. and McIntire, W.G., 1959, Quaternary Geology of the Bengal Basin, East Pakistan and India, Bull. Geol. Soc. America, v. 70, pp. 319–342.
Morgan, J.P., 1961, Mudlumps at the mouth of the Mississippi River. In: Genesis and paleontology of the Mississippi river mudlumps. Louisiana Depart. Conservation Bull. 35, p. 1–116.
Morgan, J.P., 1963, Louisiana's Changing Shoreline, La. State Univ., Baton Rouge, Coastal Studies Inst., Cont. #63-5.
Morgan, J.P., Coleman, J.M. and Gagliano, S.M., 1963, Mudlumps at the Mouth of South Pass, Mississippi River; Sedimentology, Paleontology, Structure, Origin, and Relation to Deltaic Processes, La. State University Studies, Baton Rouge, LA, Coastal Studies Series No. 10.
Morgan, J.P., 1967, Ephemeral estuaries of the deltaic environment: *In* G. H. Lauff, ed., Estuaries: AAAS Monograph, p. 115–120.
Morgan, J.P., J.M. Coleman, and S.M. Gagliano, 1968, Mudlumps: diapiric structures in Mississippi delta sediments: *In Diapirism and diapirs*: AAPG Memoir No. 8, p. 145–161.
Morgan, J.P., 1970, Deltaic sedimentation, modern and ancient: SEPM Special Publication 15, 312 p.
Morgan, J.P. and Stone, G.W., 1983, A Geomorphic Evaluation of Florida's Sandy Beaches: Methodology. *Proc. American Shore and Beach / Florida Shore and Beach Preservation Assoc.*, Boca Raton, Florida, pp. 6–19.
Morgan, J.P. and Stone, G.W., 1985, A Technique for Quantifying the Coastal Geomorphology of Florida's Barrier Islands and Sandy Beaches, *Journal American Shore and Beach Pres. Assoc.* 53(1), Jan., pp. 19–26.
Morgan, J.P. and Stone, G.W., 1987, A dune restoration and protection program for Escambia County, Florida. Report prepared for Escambia County, Pensacola, Florida, 94 pp.
Stone, G.W. and Morgan, J.P., 1983, A Geomorphic Evaluation of Florida's Sandy Beaches: Methodology. Proc. American Shore and Beach/Florida Shore and Beach Preservation Association, Boca Raton, Florida.
Stone, G.W., Fisher, D.W. and Morgan, J.P., 1985, The Variability of Florida's Coasts to Storm Wave Susceptibility. *Journal of Shoreline Management* 1:81–104.
Stone, G.W. and Morgan, J.P., 1989, Recommendations on jetty extension and channel realignment, Bayou Texar, Pensacola, Florida. Report prepared for the City of Pensacola Engineering Department, Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 89-01, 11 pp.
Stone, G.W. and Morgan, J.P., 1990, Recommendations for dredging at the mouth of Bayou Texar, Pensacola, Florida. Report prepared for the City of Pensacola Engineering Department, Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 89-02, 66 pp.
Stone, G.W. and Morgan, J.P., 1990, Sedimentation, bathymetric changes and tidal variability in Bayou Texar, Escambia County, Florida. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 02-91, 89 pp.
Stone, G.W., White, D., Morgan, J.P. and Moshiri, G.A., 1991, Sedimentation rates and macroinvertebrate distribution in Bayou Texar, Escambia County, Florida. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 04-91, 96 pp.
Stone, G.W. and Morgan, J.P., 1991, Geochemistry of subsurface sediments in Bayou Chico, Pensacola, FL. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 04-91, 120 pp.
Stone, G.W. and Morgan, J.P., 1992, Recent sediment flux and bathymetric changes in the entrance channel to Bayou Texar, Escambia County, Florida. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 02-92, 34 pp.
Stone, G.W., Stapor, F.W., May, J.P. and Morgan, J.P., 1992, Multiple Sediment Sources and a Cellular, Non-Integrated, Longshore Drift System: Northwest Florida and Southeast Alabama coast, U.S.A., *Marine Geology* 105:141-154.
Stone, G.W. and Morgan, J.P., 1992, Jack-up Pontoon Barge for Vibracoring in Shallow-Water, *Journal of Sedimentary Petrology* 62(4):739-741.
Stone, G.W. and Morgan, J.P., 1993, Implications for a Constant Rate of Relative Sea-Level Rise During the Last Millennium along the Northern Gulf of Mexico: Santa Rosa Island, Florida. *Journal American Assoc. Shore and Beach Pres. Assoc.* 61(4):24-28.
Stone, G.W., Watson, J.S., Walker, J.T. and Morgan, J.P., 1993, Heavy Metal Accumulation in Subsurface, Estuarine Sediments and Inferences for Anthropogenic Enrichment: N.W. Florida Coast *Proc. of the Eighth Symposium on Coastal and Ocean Management, American Soc. Civil Engineering* 1:899–914.
Stone, G.W. and Morgan, J.P., 1993, Sedimentation rates and geochemistry of subsurface sediments: 12th Avenue, Bayou Texar, Pensacola, Florida. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 02-93, 69 pp.
Stone, G.W., Watson, J.S., Walker, J.T. and Morgan, J.P., 1993, Heavy Metal Accumulation in Subsurface, Estuarine Sediments and Inferences for Anthropogenic Enrichment: N.W. Florida Coast. Proc. of the Eight Symposium on Coastal and Ocean Management, American Soc. Civil Engineers, New Orleans, LA.
Stone, G.W. and Morgan, J.P., 1994, Hydraulic Flow Conditions and Potential for Sediment Movement in Lower Bayou Texar and Impact of Recent Channel Dredging. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 01-94, 57 pp.
Stone, G.W. and Morgan, J.P., 1994, Bathymetric Changes at the Carpenter Creek Delta: 12 th. Avenue, Bayou Texar, Pensacola. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 02-94, 34 pp.
White, D., Stone, G.W., Morgan, J.P. and Moshiri, G.A., 1993, Relationship of benthic invertebrates to sedimentation within the vicinity of two storm water outfalls in Bayou Texar, Escambia County, Florida. Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, FL 01-93, 69 pp.

LITERATURE CITED

CORTHELL, E.L., 1880. A history of the jetties at the mouth of the Mississippi River. New York: Wiley, 383p.
COLEMAN, J.M. and GAGLIANO, S.M., 1964. Cyclic sedimentation in the Mississippi River delta plain. *Transactions Gulf Coast Association of Geological Societies*, 14, 67–80.
FISK, H.N., 1947. *Fine-grained Alluvial Deposits and their Effects on Mississippi River Activity.* U.S. Army Corps of Engineers, Mississippi River Commission, Vicksburg, Mississippi, 82p.
FISK, H.N., 1955. Sand facies of recent Mississippi delta deposits. *Proceedings 4th World Petroleum Congress* (Rome, Italy), Section 1-3, pp. 377–398.
HUMPHREYS, A.A. and ABBOTT, H.L., 1861. Report upon the Physics and Hydraulics of the Mississippi River, War Department, Bureau of Topographical Engineers, #4. *Professional Papers of the Corps of Topographical Engineers*, U.S. Army, 456p.
MORGAN, J.P., 1951. *Mudlumps at the Mouths of the Mississippi River.* 128 pages (Unpublished report for New Orleans District, Corps. Of Engineers).
MORGAN, J.P., 1952. Mudlumps at the Mouths of the Mississippi

River. *Proceedings Second Conference on Coastal Engineering* (Houston), pp. 130–144.

MORGAN, J.P., 1957. Geological Studies of the Bengal Basin. *Research Reviews, Office of Naval Research*, pp. 1–7.

MORGAN, J.P., 1959. Coastal morphological changes resulting from Hurricane "Audrey." *Proceedings Salt Marsh Conference*, The Marine Institute, U. Georgia, Sapelo Island, Georgia.

MORGAN, J.P., 1961. Mudlumps at the mouth of the Mississippi River. *In: Genesis and Paleontology of the Mississippi River Mudlumps*. Louisiana Department Conservation Bulletin 35, pp. 1–116.

MORGAN, J.P., 1963. Louisiana's Changing Shoreline. Baton Rouge: La. State University, Coastal Studies Institute, Cont. #63-5.

MORGAN, J.P., VAN LOPIK, J.R., and NICHOLS, L.G., 1953. Occurrence and Development of Mudflats Along the Western Louisiana Coast, Baton Rouge: Louisiana State University, Coastal Studies Institute Technical Report. No. 2.

MORGAN, J.P., *et al.*, 1954. *Trafficability and Navigability of the Louisiana Coastal Marshlands*. Baton Rouge: Louisiana State University, Technical Report 4.

MORGAN, J.P. and MCINTIRE, W.G., 1956. *Quaternary Geology of the Bengal Basin*. Technical Report 9, Coastal Studies Institute Contribution 56-3.

MORGAN, J.P. and LARIMORE, P.B., 1957. Changes in the Louisiana Shoreline. *Transactions Gulf Coast Assoc. Geol. Societies*, 7, p. 307.

MORGAN, J.P., NICHOLS, L.G., and WRIGHT, M., 1958. Morphological Effects of Hurricane "Audrey" on the Louisiana Coast. Baton Rouge: Louisiana State University, Coastal Studies Institute Technical Report 10.

MORGAN, J.P. and MCINTIRE, W.G., 1959. Quaternary Geology of the Bengal Basin, East Pakistan and India. *Bull. Geol. Soc. America*, 70, 319–342.

MORGAN, J.P., COLEMAN, J.M., and GAGLIANO, S.M., 1968. Mudlumps: diapiric structures in Mississippi delta sediments: *In: Diapirism and Diapirs*. American Association Petroleum Geologist Memoir No. 8, pp. 145–161.

MORGAN, J.P. and STONE, G.W., 1983. A geomorphic evaluation of Florida's sandy beaches: Methodology. *Proceedings American Shore and Beach/Florida Shore and Beach Preservation Assoc.*, (Boca Raton, Florida), pp. 6–19.

MORGAN, J.P. and STONE, G.W., 1985. A technique for quantifying the coastal geomorphology of Florida's barrier islands and sandy beaches. *Journal American Shore and Beach Preservation Association* 53(1), pp. 19–26.

MORGAN, J.P. and STONE, G.W., 1987. *A Dune Restoration and Protection Program for Escambia County, Florida*. Report prepared for Escambia County Planning Department, Pensacola, Florida, 94p.

RUSSELL, R.J., 1936. Physiography of lower Mississippi River delta: Lower Mississippi River Delta. *Geological Bulletin 8,* Louisiana Geological Survey, 199p.

STONE, G.W. and MORGAN, J.P., 1983. On the concept of storm wave susceptibility and its application to four Florida coastal areas. *Proceedings American Shore and Beach/Florida Shore and Beach Preservation Association* (Boca Raton, Florida), pp. 19–37.

STONE, G.W., FISHER, D.W., and MORGAN, J.P., 1985. The Variability of Florida's Coasts to Storm Wave Susceptibility. *Journal of Shoreline Management*, 1, 81–104.

STONE, G.W., GRYMES, J.M., DINGLER, J.R., and PEPPER, D.A., 1997. Overview and significance of hurricanes on the Louisiana coast, USA. *Journal Coastal Research,* 13 (3), 656–669.

VAN LOPIK, J.R., 1955. Recent geology and geomorphic history of central coastal Louisiana. Baton Rouge: Louisiana State University, Coastal Studies Institute, Technical Report 7.

WELDER, F.A., 1959. Processes of Deltaic Sedimentation in the Lower Mississippi River. Baton Rouge: Louisiana State University, Coastal Studies Institute, Technical Report 12, pp. 1–90.