

MILES O. HAYES

Coastal Geomorphologist and Sedimentologist

EXPERTISE Coastal geomorphology and processes
Sedimentology; depositional systems
Environmental hazards (including beach erosion)
Fluvial geomorphology and sedimentology
Oil-spill response and contingency planning
Education and professional training

SYNOPSIS

General

Dr. Miles O. Hayes is a coastal and fluvial geomorphologist and sedimentologist with over 50 years of experience in research on hydrodynamic processes and sedimentation. He has authored over 250 articles and reports on numerous topics relating to tidal hydraulics, river morphology and processes, beach erosion, barrier-island morphology, oil pollution, and petroleum exploration. Based on extensive field experience throughout the world, he has developed innovative techniques regarding environmental protection, depositional modeling, and shoreline processes.

Original Concepts

Original concepts proposed and developed by him include: 1) importance of hurricanes to barrier island and nearshore shelf sedimentation; 2) effect of tides on shoreline morphology and sedimentation patterns (particularly in embayments); 3) morphology of tidal inlets; 4) the mesotidal beach cycle; 5) applications of coastal geology to oil-spill response; 6) the coastal Environmental Sensitivity Index (ESI) for oil spills, which has been used to map most of the coastline of the USA and many other coastlines of the world; and 7) the Reach Sensitivity Index (RSI) for oil spills in small rivers and streams.

Training

Hayes' teaching experience includes a range of both undergraduate and graduate courses while a professor at the Universities of Massachusetts and South Carolina. Seventy-two graduate students received their degrees under his supervision, most of whom are now leaders in their respective academic, government and industry positions.

Dr. Hayes led the highly successful Modern Clastics Field Seminar on the South Carolina Coast (week-long courses sponsored by the American Association of Petroleum Geologists and other industry clients) for 30 years (1976-2005). During this time, over 150 individual courses were completed in which several thousand geologists were trained. A similar course was offered on the Alaska coast as well (in 1980s).

He is co-leader of various RPI courses on Oil Spill Planning and Response, a week-long training exercise for both government and industrial clients, encompassing numerous topics from inlet protection strategies to appropriate cleanup plans for oil in rivers and on beaches.

Coastal Geomorphology

Throughout his career, Dr. Hayes has been a leader in the application of basic geomorphological concepts to solve critical coastal erosion problems. Examples include: 1) development of set-back lines for the developers of Kiawah Island, South Carolina; 2) several coastal erosion projects on the coast of West Africa; and 3) a variety of other projects in New England, Baja California, etc. He also has worked in Kuwait in 1975-1980, as part of the coastal design team for the Kuwait City Waterfront Masterplan.

River Geomorphology

Dr. Hayes has supervised and participated in research on river systems in the following areas: 1) Braided streams of the Sandur Plain of Iceland; these studies resulted in another project on study of braided channels on Mars, funded by NASA; 2) Braided streams on the outwash plains of southeast Alaska, including the Copper River delta; 3) Analysis of low-stand alluvial valley, floodplain, and point-bar deposits on the coastal plains of the southeastern U.S, including the Santee Delta.; 4) Development of a stream reach classification system for the Santee River system in South Carolina, sixteen rivers in Puerto Rico, four rivers in northeast Louisiana; and the Leaf River in Mississippi; 5) Mapping of riverine morphology and habitats on the Appalachicola River and the St. Johns River, Florida; and 6) Braided stream system in New Guinea.

Oil Spills

Hayes has had first hand experience at many of the major oil spills that have occurred in the past 30 years, including the *Metula* (Chile, 1974), *Urquiola* (Spain, 1977), *Amoco Cadiz* (France, 1978), *Ixtoc I* (Gulf of Mexico, 1979), *Exxon Valdez* (Alaska, 1989), and the Gulf War spills (Kuwait and Saudi Arabia, 1991). For many of these spills, he has conducted studies on the effects and effectiveness of cleanup methods, and the long-term fate and effect of oil residues. He led a multi-national field team for 6 weeks in 1992 conducting a comprehensive assessment of the oil impacts on intertidal shoreline habitats in Saudi Arabia. These surveys were repeated in 1993 and 1997. In 2002-3, he was the Project Manager for the Oiled Shoreline Survey of 800 km of the Saudi Arabian coast, leading 7 teams conducting detailed shoreline mapping to support environmental damage claims against Iraq from the Gulf War oil spills.

As part of the NOAA Scientific Support Team, he has provided 24-hour technical support to the U.S. Coast Guard for oil and chemical spills nationwide. He is co-author of over 60 papers, reports, and abstracts on the effects of oil spills on coastal environments. He created the original concept of sensitivity mapping and shoreline sensitivity ranking for oil spill planning in 1976. This sensitivity mapping concept has been a key component of oil spill planning and response since then, with worldwide application. He has also revolutionized the approaches to inlet protection strategies, merging his knowledge of flow patterns in inlets (based on over 30 years of research on tidal inlets) with the operational experience of on-scene spill response, to develop realistic, yet effective strategies for boom placement and oil recovery. He has applied these same approaches to spill response in rivers, with the development of the Reach Sensitivity Index, which includes strategies for spill response in rivers.

Books *Coastal Geology and Ecology of Georgia*, 2013 (with J. Michel), Pandion Books, Columbia, SC.
 Coastal Heroes, 2011, Pandion Books, Columbia, SC.
 Coastal Geology and Ecology of Central California, 2010 (with J. Michel), Pandion Books, Columbia, SC.
 A Naturalist Guide to the Coast of South Carolina, 2008 (with J. Michel), Pandion Books, Columbia, SC.
 Black Tides, 2000. University Texas Press.
 Terrigenous Clastic Depositional Environments, (with T.W. Kana), 1976.
 Fan Deltas as Exploration Targets, 2005. RPI, Louisiana.
 Hurricanes as Geological Agents, 1965. University of Texas, Bureau of Economic Geology.

Other Artistic Products Two audiovisual concerts (“Suzanne’s Lament”, (1970) and “A Day Just like Today” (1974)
 Movie “Walking to Kuwait” (2003)
 CD-ROM “South Carolina Coastal Environments” (2000)

Honors Fall, 2013 Special Issue 69 Of the Journal of Coastal Research - Proceedings, Symposium in Applied Coastal Geomorphology to honor Miles O. Hayes.

 In January 2013, named one of the four Legends of Sedimentology by the Houston Geological Society.

 In 1997, he was awarded the Francis P. Shepard Marine Geology award by the Society of Economic Paleontologists and Mineralogists, the highest award for Marine Geologists.

EDUCATION

1952-1957 Berea College, Berea, Kentucky; B.A. in Geology.
1957-1959 Washington University at St. Louis; M.A. in Geology.
1959-1965 University of Texas; Ph.D. in Geology and Marine Science. Ph.D. Dissertation: Sedimentation on a Semi-Arid, Wave-Dominated Coast (South Texas); With Emphasis on Hurricane Effects.

PROFESSIONAL EXPERIENCE

1. March 1977-present, Chairman of the Board of Research Planning, Inc., 1121 Park Street, Columbia, South Carolina.
2. September 1973-September 1977, Head, Department of Geology, University of South Carolina, Columbia, South Carolina.
3. September 1972-July 1984, Professor of Geology and Marine Science and founder and Director of the Coastal Research Division, Department of Geology, University of South Carolina, Columbia, South Carolina.

4. 1964-1972, Lecturer to Associate Professor, Geology Department, University of Massachusetts, Amherst, Massachusetts; founder and Director of the Coastal Research Center at the University.
5. 1960-1964 (part-time); summer, 1965; research scientist, Defense Research Laboratory, University of Texas. Work on oceanographic and undersea warfare problems for U.S. Navy (classified work).

ENVIRONMENTAL SENSITIVITY INDEX (ESI) MAPPING

ESI atlases have been prepared for the following areas:

Bristol Bay area of the Bering Sea, Alaska	Upper Texas Coast
Prince William Sound, Alaska	South Texas
Kotzebue Sound, Alaska	South Carolina
Norton Sound, Alaska	Florida Coast
Kodiak Archipelago South East Alaska	Nigeria
New York/New Jersey	Lake Ontario, New York
Lake Superior	Gaza Strip
St. John's and Appalachian Rivers Florida	Puerto Rico
Panama Canal	Virgin Islands
Cook Inlet and Kenai Peninsula, Alaska	El Salvador
Strait of Juan de Fuca and northern Puget Sound	Southern Alaska Peninsula
Gulf of Aqaba	Kuwait

SCIENTIFIC EXPEDITIONS

Participated in over 100 scientific expeditions since 1960. Field studies have been carried out in the following areas:

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| 1) Alacran Reef and Isla Mujeres, Mexico | 19) Brittany, France |
| 2) Texas coastal plain and continental shelf | 20) Alberta, Canada |
| 3) Antarctica | 21) Puerto Rico |
| 4) New England coast (entire) | 22) Puget Sound, Washington |
| 5) Most of the coastal area of Alaska | 23) California coast |
| 6) Baja California, Mexico | 24) Venezuela |
| 7) Florida coast (entire) | 25) El Salvador |
| 8) Chile and Argentina | 26) Kuwait |
| 9) Spain | 27) Oman |
| 10) Red Sea Coast and Arabian Gulf of Saudi Arabia | 28) China |
| 11) Bahamas and West Indies | 29) North Korea |
| 12) Arctic Islands | 30) Vietnam |
| 13) Gulf of St. Lawrence | 31) Jordan (Gulf of Aqaba) |
| 14) Iceland | 32) Israel |
| 15) Great Lakes | 33) Ghana (Keta Lagoon) |
| 16) Georgia Embayment | 34) New Jersey Tidal Inlets |
| 17) French West Africa | 35) Gaza Strip |
| 18) Rocky Mountains, USA | 36) Panama Canal |
| | 37) Indonesia |

PUBLICATIONS

Hayes has published over 250 scientific papers. Also, he has published and presented over 100 abstracts at professional meetings. Selected citations from his list of publications are presented below.

- (2014) M.O. Hayes and J. Michel. Sand Beaches of the Northeast Coast of Saudi Arabia. Posted in Beach of the Month, Features. <http://coastalcare.org/2014/04/sand-beaches-of-the-northeast-coast-of-saudi-arabia/>.
- (2013) Hayes, M.O. and J. Michel. A Tide-swept Coast: Coastal Geology and Ecology of Georgia. Pandion Books, Columbia, SC, 299 p.
- (2013) M.O. Hayes and D.M. FitzGerald. Origin, evolution, and classification of tidal inlets. *Journal of Coastal Research*, Special Issue No. 69:14-33.
- (with four others), 2013. Geomorphic factors related to the persistence of subsurface oil from the *Exxon Valdez* oil spill. In: Kana, T., J. Michel, and G. Voulgaris (eds.), Proceedings, Symposium in Applied Coastal Geomorphology to Honor Miles O. Hayes, *Journal of Coastal Research*, Special Issue No. 69:115-127.
- (with three others), 2011. The distribution of lingering subsurface oil from the *Exxon Valdez* oil spill. Proc. 2011 Intl. Oil Spill Conference, American Petroleum Institute, Washington, D.C.
- (2010) Hayes, M.O. and J. Michel. A Coast to Explore: Coastal Geology and Ecology of Central California. Pandion Books, Columbia, SC, 338 p.
- (with seven others), 2010. Distribution of subsurface oil from the *Exxon Valdez* oil spill. *Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 070801)*, National Oceanic and Atmospheric Administration, Juneau, AK. 121 pp. + app.
- (2010) Hayes, M.O.; Michel, J., and Betenbaugh, D.V. The intermittently Exposed, Coarse-Grained Gravel Beaches of Prince William Sound, Alaska: Comparison with Open-Ocean Gravel Beaches. *Jour. of Coastal Research*. Vol. 26, No. 1.
- (2009) Barrier islands. In: Gillespie, R. and Clague, D. (eds.) *Encyclopedia of Islands*. Berkeley, Univ. Cal. Press, pp. 82-88.
- (2008) Hayes, M.O. and J. Michel. A Coast for All Seasons: A Naturalist's Guide to the Coast of South Carolina. Pandion Books, Columbia, SC, 285 p.
- (2007) Hayes (et al.). The impact of the Gulf War (1990-1991) oil release upon the intertidal Gulf coastline of Saudi Arabia and subsequent recovery.
- (2006) Co-author of the paper: The Gulf war oil spill twelve years later: long-term impacts to coastal and marine resources. Presented at the Offshore Arabia Conference in Dubai. Mid-December. Proceedings.
- (2006) Co-author of the paper: Impacts of the 1991 gulf war oil spill on mangrove and salt marsh habitats along the Saudi Arabian Gulf coast as of 2002-2003. Presented at the Offshore Arabia Conference in Dubai. Mid-December. Proceedings.
- (2005) Tide-dominated Coasts; *Encyclopedia of Coastal Science*. M. Swartz (ed.). Elsevier, pp. 982-984.
- (2005) Wave-dominated Coasts; *Encyclopedia of Coastal Science*. M. Swartz (ed.), Elsevier, pp. 1053-1056.

- (2005) Barrier Islands; Encyclopedia of Coastal Science. M. Swartz (ed.), Elsevier, pp.117-119.
- (with J. Michel, C. D. Getter, and L. Cotsapas), 2005. The Gulf war oil spill twelve years later: consequences of eco-terrorism. Proc. 2005 International Oil Spill Conference, American Petroleum Institute, Washington, D.C. (CD-ROM).
- (with R.B. Nairn), 2004. Natural maintenance of sand ridges and linear shoals on the U.S. Gulf and Atlantic continental shelves and the potential impacts of dredging. J. Coastal Research, 20:138-148.
- (with W. F. Baird), 2003. Country-wide assessment of coastal erosion and sand-budget analysis. Proc. International Conference on "Coastal Zone Management and Development", March 18-20, 2002, Kuwait City, Kuwait.
- (with seven others), 2001. Integrated planning from the mountains to the sea: Environmental Sensitivity Index mapping in the Caribbean, 2001. In Proc. 2001 International Oil Spill Conference, API Publ, American Petroleum Institute, Wash., D.C., pp. 1113-1117.
- (with J. Michel), 2001. A primer for response to oil spills on gravel beaches. 2001 International Oil Spill Conference, API Publ., American Petroleum Institute, Wash., D.C., pp. 1275-1279.
- (with J. Michel), 1999. Factors determining the long-term persistence of *Exxon Valdez* oil in gravel beaches: Marine Pollution Bull., Vol. 38, pp. 92-101.
- (with three others), 1999. Tidal inlets-A major hurdle to protecting sensitive coastal resources. Proc. 1999 International Oil Spill Conf., American Petroleum Institute, Washington, D.C., pp. 1239-1243.
- An Atlas of Riverine and Estuarine Habitats and Wildlife of the St. Johns River, Florida, 1997. Prepared for the Hazardous Materials Response Division, National Oceanic and Atmospheric Administration, Seattle, Wash., 31 maps.
- (with J. Michel and T.M. Montello), 1997. The reach sensitivity index (RSI) for mapping rivers and streams: In Proc. 1997 Intl. Oil Spill Conf., Ft. Lauderdale, Fla.
- (with R. Nairn), 1997. Large-scale coastal evolution in the vicinity of Keta Lagoon, Ghana. Proc. International Conference on Coast Research Through Large-Scale Experiments. University of Plymouth.
- Barrier Island Basics, Geotimes, September 1996, p. 17.
- (with W.J. Sexton), 1996. Holocene deposits of reservoir-quality sand on the South Carolina coastline. AAPG Bull. Vol. 80, No. 6, pp. 831-855.
- (with C.H. Ruby), 1994. Chapter 10: Pacific Coast of Alaska: In Barrier Islands (R.A. Davis, Jr., Ed.), Springer Verlag, N.Y., pp. 395-433.
- Chapter 7: Georgia Bight, 1994. In Barrier Islands (R.A. Davis, Jr., Ed.), Springer Verlag, N.Y., pp. 233-304.
- (with five others), 1993. Gulf War legacy using remote sensing to assess habitat in the Saudi Arabian Gulf before the Gulf War oil spill: GeoInfo Systems, pp. 33-41.
- (with W.F. Baird), 1993. Shoreline erosional/depositional patterns in Oman. Coastal Engineering Considerations in Coastal Zone Management, ASCE, New York, pp. 144-158.

- (with seven others), 1993. Distribution and weathering of shoreline oil one year after the Gulf War oil spill: *Marine Pollution Bulletin*, Vol. 27, pp. 135-142.
- (with three others), 1993. Evolution of the Santee/Pee Dee Delta complex, South Carolina, USA: In *Coastal Zone '93*, New Orleans, La., July 1993.
- (with four others), 1993. Oil in nearshore subtidal sediments of Saudi Arabia from the Gulf War spill: in *Proc. 1993 International Oil Spill Conf.*, American Petroleum Institute, Wash., D.C., 383-388 pp.
- (with W.J. Sexton), 1991. The geologic impact of Hurricane Hugo and post-storm shoreline recovery along the undeveloped coastline of South Carolina, Dewees Island to the Santee Delta: *J. Coastal Estuarine Science*, Special Issue 8, pp. 275-290, 1991.
- Geomorphology and sedimentation patterns in tidal inlets A Review, 1991. *Coastal Sediments '91*, ASCE, Proceedings, Vol. II, pp. 1343-1355.
- (with J. Michel), 1989. Modern clastic depositional systems of south-central Alaska, field trip guidebook T101, 28th International Geological Congress, 29- June - 7 July 1989: Pub. by American Geophysical Union, Wash., D.C., 42 pp.
- Regional variation of barrier islands in the Georgia Bight, analysis by compartment: *NE GSA Ann. Mtg.*, Invited Symposium Paper, New Brunswick, N.J., 1989.
- (with J.C. Boothroyd), 1987. Storms as modifying agents in the coastal environment: In R.A. Davis, Jr. (Ed.), *Beaches and nearshore sediments and processes*. SEPM, Tulsa, OK, Reprint Series No. 12, pp. 25-39.
- (with R.A. Davis, Jr.), 1984. What is a wave-dominated coast? *Marine Geology*, Vol. 60, pp. 313-329.
- (with Kana, T.W., J. Michel, and J.R. Jensen), 1984, The physical impact of sea-level rise in the area of Charleston, South Carolina: In M.C. Barth and J. Titus (eds.), *Greenhouse Effect and Sea Level Rise: A Challenge for This Generation*: Van Nostrand Reinhold Co., New York, N.Y., pp. 105-151.
- (with J. Michel), 1982. Shoreline sedimentation with a forearc embayment, lower Cook Inlet, Alaska: *Jour. Sed. Petrol.*, Vol. 52, pp. 251-263.
- General morphology and sediment patterns in tidal inlets: *Sed. Geol.*, Vol. 26, pp. 135-156, 1980.
- (with C.H. Ruby), 1978. Oil spill vulnerability index, Copper River Delta, Alaska: in *Proc. Coastal Zone '78*, San Francisco, Calif., pp. 2204-2220.
- Terrigenous Clastic Depositional Environments, 1976. American Association of Petroleum Geologists Field Seminar Lecture Notes.
- Morphology of sand accumulation in estuaries; an introduction to the symposium: In L.E. Cronin (Ed.), *Estuarine Research*, Vol. II, Academic Press, N.Y., pp. 3-22, 1975.
- (with E.H. Owens, D.K. Hubbard, and R.W. Abele, Jr.), 1973. Investigation of form and processes in the coastal zone: In D.R. Coates (Ed.), *Coastal Geomorphology*, Proc. 3d Ann. Geomorphology Symposia Series, Binghamton, N.Y., pp. 11-41.
- Summary of geological effects of hurricanes Carla, 1961, and Cindy, 1963, on the south Texas coast: In *Field Trip Guidebook Depositional Environments*, South-Central Texas Coast,

Gulf Coast Assoc. Geol. Societies, Ann. Mtg., Corpus Christi, Tex., pp. 127-136, 28-31
October 1964.

Hurricanes as geological agents; south Texas coast: Am. Assoc. Petroleum Geologists Bull., Vol.
5116, pp. 937-941, June 1967.

Relationship between coastal climate and bottom sediment type on the inner continental shelf:
Jour. Marine Geology, Vol. 5, pp. 111-132, 1967.

(with A.J. Scott), 1964. Environmental complexes, south Texas coast: Gulf Coast Assoc. Geol.
Societies, Trans.; Vol. XIV, pp. 237-240.