U.S GEOLOGICAL SURVEY
RESEARCH SCIENTIST RECORD

1. NAME **George R. Sample**

2. DATE PREPARED 12/30/1999

3. DUTY STATION Anywhere, USA

4. REGION Central

5. CLASSIFICATION TITLE, SERIES, AND GRADE Geophysicist GS 1313-14

6. DATE OF ENTRANCE ON DUTY 3/77

8. DATE OF LAST PROMOTION 12/91

9. EDUCATION

Waterway High School	9/65 - 9/69		Diploma - 1969
S.U.N.Y., Stony Brook	9/69 - 6/73	Geology	B.A. - 1973
Un. Of Washington	9/73 - 12/75	Geology/Geophysics	M.S. - 1976
Scripps	9/79 - 12/85	Marine Geology	Ph.D. - 1985

10. TECHNICAL TRAINING RECEIVED

10/92 - High Performance Organizations Management Training Program

11. PROFESSIONAL EXPERIENCE

a. PRESENT ASSIGNMENT

DATES From: 1995 **To:** Present

(1) **Regional Sea-Floor Mapping New York Bight APEX** (25%)
This multidisciplinary, multi-agency multi-institution project provides a regional synthesis of the sea-floor geology off the New York metropolitan area using several geophysical imaging techniques and sampling strategies. Products from this project (e.g., maps of sea-floor sediment texture, sediment bedforms, and the geometry of surficial sedimentary deposits) are used as the framework for investigating pollutant dispersal in the New York Bight, for identifying acceptable sites for disposal of dredge spoils from New York Harbor, for identifying offshore aggregate resources, for understanding geologic processes affecting coastal erosion, and for assessing anthropogenic impacts on benthic habitats caused by bottom trawling. *As a Co-Principal Investigator for this project, I am the principal science investigator for all mapping efforts and for interpreting the influence of antecedent geology (including sea-level rise) on modern surficial processes. I also coordinate cooperatives with three universities and two divisions of the Army Corps of Engineers, which are jointly funding the project, I am frequently called as an expert witness for the Corps and their consultants.* (Project is cost-shared with the USGS and the US Army Corps of Engineers)

(2) **Coastal Erosion and Sand Resources of Southern Long Island** (25%)
Because of the large erosion and beach replenishment issues along southern Long Island, NY, the US Army Corps of Engineers asked the USGS to jointly undertake a study of the coastal evolution and modern behavior of the Long Island barrier-island system and adjacent inner shelf. This study area also includes one of the most heavily visited parks in the nation, the Fire Island National Seashore, where there is contentious and frequent debate between homeowners, politicians, Fish & Wildlife, the Corps, and the National Park Service about mitigating shoreline change. *As Project Chief, I direct all science investigations (e.g., remote mapping, Pleistocene and Holocene sediment thickness maps, surficial sediment distribution, assessment of net sediment transport direction, coastal and shoreline evolution, and the role of pre-existing geology on the sedimentologic framework); I coordinate cooperatives with University investigators, USGS BRD (link with the Park Service) and the USACOE; and I frequently attend public interest meetings in Long Island to provide scientific input to otherwise emotional and political policy debates about shoreline issues.* (Project is cost-shared with the USGS and the US Army Corps of Engineers)

(3) **Synthesis of Inner Shelf Geologic Processes** (15%)
Because the USGS has conducted numerous small inner-shelf mapping projects along the US East Coast to understand shoreline change and the links to shelf depositional processes, I initiated a 2-yr synthesis project that integrates a predictive modelling component with results from projects from Puerto Rico, South Carolina, North Carolina, and New York. The goal is to identify fundamental processes that may have influenced coastal evolution. *I determined the science direction for this project, interact with the modelling PI (Richard Signell), and coordinate with three university groups, USGS-WRD, and NOAA-NURP.* (Project is USGS-funded)

(4) **South Carolina Coastal Erosion** (5%)
Goals of this multidisciplinary, multi-institutional study of the SC coastal system are to establish a state-wide sediment budget, quantify longshore sediment transport gradients, determine the effects of modifying inlet channels, and establish the interaction of adjacent beach and inlet systems using nearshore physical properties, regional geology, and shoreline geometry. *Under guidance of the Project Chief (Terry Edgar), I am responsible for conducting detailed imaging of the shoreface and inner shelf areas using sidescan sonar imaging, and to help interpreting the imagery and other offshore sedimentologic framework data.* (Project is USGS-funded)

(5) **Sea-Floor Mapping Technology Project, Woods Hole** (30%)
This project maintains the USGS Coastal and Marine Team s position at the forefront of high-resolution marine mapping technology by keeping our existing equipment and capabilities in full operational status, adding new equipment to our present capabilities, and ensuring that the technical staff are adequately trained for both field acquisition experiments and processing/analysis of the data. *As Project Chief, I plan, direct, and supervise all aspects of equipment development and technical support of sea-floor mapping investigations at the Woods Hole Center, coordinate with technical support groups from the Menlo Park and St. Petersberg Centers, and supervise 13 personnel who are part of the Sea-Floor Mapping Group.* (Project funded by the USGS)

b. PREVIOUS PROFESSIONAL POSITIONS

PUERTO RICO MARINE GEOLOGY PROGRAM (1988-1996)
This Project stressed systematic reconnaissance mapping of the entire insular shelf as its primary objective. However, increasing concern with the erosion of Puerto Rico s coastal area led to a series of investigations related to coastal zone processes; including historical shoreline-change analysis for the entire island. This program was jointly funded by the USGS and the Commonwealth Department of Natural Resources. *As Project Chief,I supervised the USGS Puerto Rico Marine Geology Program field office in San Juan, PR. Duties included coordination of cooperative efforts with research personnel from the University of Puerto Rico, USGS Water Resources Division San Juan, University of the West Indies, and from Coastal & Marine Geology Programs in Woods Hole, Menlo Park, and St. Petersburg. My research focus was assessment of the impact of major storm events and other hazards on the coastal resources of Puerto Rico.*

SUBMARINE VOLCANIC TERRANES (1984-1988)
Project objectives included: (a) reconnaissance investigations and exploration of neovolcanic zones of Mohns Ridge and the East Pacific Rise in cooperation with investigators from Woods Hole Oceanographic Institution, Institut de Physique du Globe de Paris, University of Rhode Island, IFREMER, Brown University, Norwegian Navy, Office of Naval Research, and the US Navy; and (b) marine mineral resource assessment of ferromanganese-oxide crusts on mid-Pacific seamounts. *As Project Scientist, I (a) served as Project Chief on Mohn s Ridge investigation with primary responsibility to apply state-of-art video and sidescan-sonar techniques to analysis of mid-ocean ridge dynamics (including analysis and mapping of all remotely sensed data); and (b) related physical oceanographic and sedimentologic environment of seamounts to sediment behavior, crust growth, and crust chemical composition using sedimentologic and geotechnical analysis of sediment cores and interpretation of all seismic-reflection data.*

EEZ MARINE GEOLOGY: MASS MOVEMENT PROCESSES (1980-1996)
This research topic was a series of studies designed to create a better understanding of the processes that control the initiation of submarine slope failure, the mobility (strain) of material that has been set into motion as a result of submarine slope failure, and the geotechnical engineering and rheologic processes that affect or control the stratigraphic development of mass movement deposits. *As a geophysicist/sedimentologist participating in several projects, my responsibilities included: (a) assessment of the geotechnical and rheological processes affecting the stratigraphic development of the Mississippi Fan; (b) application of steady-state soil mechanics theory to submarine slope failure and sediment gravity flow in glacial-marine sediment, carbonate sediment, and prodelta material; and (c) conducting regional sediment processes studies related to Outer Continental Shelf Oil and Gas Lease Sale Regional Environmental Hazards Program (Gulf of Alaska and Bering Sea).*

NE GULF OF ALASKA ENVIRONMENTAL HAZARDS (1977-1980)
Project objective was to develop a quantitative structural and tectonic interpretation of the development of the Cenozoic section in the northeast Gulf of Alaska. *As a geophysicist, I conducted processing, interpretation, and structural analysis of seismic-reflection and magnetic data in an active tectonic regime of oblique subduction.*

12. SIGNIFICANT RESEARCH ACCOMPLISHMENTS

a. RECENT ACCOMPLISHMENTS

MAPPING OF THE EEZ OFFSHORE OF THE NEW YORK - NEW JERSEY METROPOLITAN AREA

RESULTS - A series of marine geologic maps of the sea floor offshore of the New York - New Jersey metropolitan area are being completed as well as products that describe the sedimentary environments, sediment texture, sea-floor morphology, geologic history, and the geometry and structure of the Quaternary strata. Preliminary interpretation of the mapping products (a) provides a framework for assessment of anthropogenic impact of historic and ongoing waste disposal operations; (b) shows changes in sediment properties over short spatial scales that are controlled by both modern processes and the antecedent framework; (c) suggests the presence of a variety of active sediment transport processes; (d) defines the major Pleistocene drainage system including the evolution of the Hudson Shelf Valley; (e) defines the evolution of the Holocene sedimentary deposit (and shelf); (f) defines the sedimentologic record of Holocene marine transgression; (g) extends the mapping of major Long Island aquifers offshore; and (h) identifies sand and gravel deposits with potential economic significance. Mapping results show that the Holocene sedimentary deposit is thin or absent over much of the continental shelf. This Holocene sedimentary deposit originated primarily from erosion of exposed Pleistocene deposits and Cretaceous/early Tertiary outcrops during Holocene marine transgression. Thus, much of the sea-floor sediment cover is an expression of the formation and modification of a ravinement surface. Bedforms and sediment distribution patterns indicate that the seabed continues to be active, in that there is a net sediment (and pollutant) bedload transport direction (storm-induced) to the southeast, toward the Hudson Shelf Valley.

SIGNIFICANCE OF RESULTS - This project (and the SAND RESOURCES project described below) is technically challenging, in that, it calls for the mapping of a large segment of the shallow inner-inner shelf using high-resolution sidescan-sonar, seismic-reflection, and bathymetric methodology; an unprecedented amount of

digital data (collected in an acoustically noisy environment) to process, interpret, synthesize, and archive. The project was motivated by the need to develop an environmentally acceptable solution for the disposal of dredged material from the New York - New Jersey Port, and by the opportunity to develop a better understanding of the transport and long-term fate of contaminants into the New York Bight over the last 100+ years. These mapping products are currently being used by the U.S. Army Corps of Engineers to develop dredge disposal plans, by the Environmental Protection Agency to evaluate the impact of current dredge spoil disposal methods and to plan reclamation strategy, and by the National Marine Fisheries Service to study fishery habitats in the NY Bight. These data and mapping products will be used as baseline information for decades.

SCIENTIFIC IMPACT - A key science impact is that the mapping products define, for the first time, the Quaternary evolution of the New York Bight inner-continental shelf in detail, including the relation of sea level transgression to the development of sedimentary deposits and their geometries. This knowledge is necessary in order to develop conceptual models designed to predict the response of coastal areas to future sea-level rise.

RESEARCH CONTRIBUTIONS - I am responsible for the development and scientific leadership of this project (see project description above). I am working with cooperators in academia to develop a regional environment framework of the New York Bight Apex and to assure that the USGS meets our responsibilities to the US Army Corps of Engineers with whom this project is cost-shared.

SAND RESOURCES OF THE LONG ISLAND, NEW YORK INNER SHELF

RESULTS - This project provides a unique opportunity to investigate the role that the physiography and stratigraphic framework of the inner shelf has on the dynamics of coastal change along a continuous 150-km-long length of shoreline (i.e., on a regional scale). The investigation has established a link between inner-shelf Holocene sand availability and beach erosion rates and a link between inner-shelf physiography with modern coastal behavior. In addition, core results and sediment depositional patterns reveal the presence of two paleo-shorelines (10,000 and 8,000 yr BP).

SIGNIFICANCE OF RESULTS - These mapping products provide critical information necessary for assessment of offshore sand resources needed for planned beach nourishment projects along the Long Island barrier-island system. These mapping products are currently being used by the US Army Corps of Engineers to develop plans for extraction of sand and to evaluate the environmental impact of this exploitation. In the case of southern Long Island, net onshore sediment flux, from the inner shelf to the littoral zone, is a significant component of the overall sediment budget, and must be considered in overall erosion mitigation strategy. In addition, the refined understanding of Holocene marine transgression rates coupled with the sedimentologic framework forms a basis of being able to predict the impact of future transgression on the modern shoreline.

SCIENTIFIC IMPACT - A key science impact of this research is that it demonstrates the importance in understanding the influence of the nearshore framework geology and processes controlling sediment transport on the inner shelf when attempting to develop a coastal sediment budget or to develop a coastal-erosion mitigation strategy. This changes changes decades-old coastal-engineering ideas that processes occurring on the inner-shelf (water depths greater than approximately 5 m) can be ignored.

RESEARCH CONTRIBUTIONS I am responsible for the scientific leadership of this project. This includes providing technical support to cooperators and participation in all aspects of scientific planning.

GEOMORPHIC ANALYSIS OF SHOREFACE/INNER SHELF REMOTELY SENSED DATA

RESULTS - Evidence for cross-shelf sediment flux between the inner shelf and littoral zone has been found off Folly Beach, SC, Wrightsville Beach, NC and off Long Island, NY. This sediment flux appears to be significant in affecting shoreline evolution in these three study areas. In all study areas, unusual, large-scale bedforms (including rippled scour depressions) formed by erosion of the sea floor have been identified in the nearshore environment and can be used to assess net sediment transport directions.

SIGNIFICANCE OF RESULTS/SCIENTIFIC IMPACT - Mapping efforts in the nearshore regime show that relatively minor variations in sea-floor physiography and composition can have a rather major impact on sediment distribution, coastal evolution, and historical shoreline behavior. A practical understanding of sediment transport from just seaward of the surf zone to inner-shelf depths is rudimentary at best. Although shore-parallel sediment transport in the littoral zone is widely accepted as the primary factor controlling beach behavior, the importance of cross-shelf sediment flux is poorly understood and generally not accepted in many coastal engineering projects. Results of this project strongly argues that this practice is fundamentally incorrect, and can lead to poor engineering design.

RESEARCH CONTRIBUTIONS - I am responsible for the scientific leadership of this project. This includes providing technical support to cooperators and participation in all aspects of scientific planning.

b. OTHER CAREER ACCOMPLISHMENTS

PUERTO RICO MARINE GEOLOGY PROGRAM

RESULTS - (a) A sea-floor mapping investigation funded by special appropriation from the Department of Interior was conducted off the northeast coast of Puerto Rico to assess the sediment distribution, the movement of nearshore sand supply, and the fate of sediment eroded from the shoreline during major storm events. Mapping results showed that regional oceanographic processes result in a net offshore direction of sediment transport on the insular shelf. Coastal sediment is, however, not transported seaward of a series of shore-parallel Pleistocene eolianite ridges that outcrop on the middle shelf.
(b) Analyzed existing geophysical and stratigraphic data over a large-scale debris avalanche scar north of Puerto Rico (southern flank of the Puerto Rico Trench) that may have tsunamogenic implications.

SIGNIFICANCE OF RESULTS/SCIENTIFIC IMPACT - (a) The steep and narrow nature of the northern insular shelf of Puerto Rico and its exposure to high-energy wave conditions were thought to promote rapid cross-shelf sediment transport, however detailed mapping did not exist to verify this model. Mapping results not only supported the model of cross-shelf sediment transport, but linked this sediment flux to coastal change.
(b) High rates of subsidence in the area of the Puerto Rico trench appears to have been responsible for the formation of a series of slope failures which may pose a future tsunami hazard to the north shore of the island.

RESEARCH CONTRIBUTIONS - I was responsible for the scientific leadership and to assure that the USGS met its obligations to the Commonwealth Department of Natural Resources (and other Commonwealth agencies that provided funds to the USGS Marine Program). I wrote the proposal which resulted in the special appropriation from the Secretary of the Interior to study the effects of major storm events on the coastal resources of Puerto Rico.

SUBMARINE VOLCANIC TERRANES

RESULTS - (a) Mapped the neovolcanic zone of the East Pacific Rise (10¡19 N to 11¡53 N) and Mohn s Ridge (Norwegian Sea). Observations support the concept that magmatic activity along spreading centers is episodic and that such activity is not continuous throughout the ridge segments at any given time; magmatism follows a cyclical pattern, progressing from initial pillow-lava emplacement, to extrusion of sheet flows, to a waning phase of pillow extrusion, and finally to pelagic sedimentation.
(b) Established baseline information on regional geochemical variation and geologic and oceanographic conditions conducive to the origin and evolution of ferromanganese-oxide crusts (marine mineral deposits) which cover most hard substrates on sea floor edifices in the Central Pacific basin.

SIGNIFICANCE OF RESULTS/SCIENTIFIC CONTRIBUTIONS - (a) During East Pacific Rise investigation, established, for the first time, that deep-sea video systems can be used efficiently to map volcanic terranes in real-time at the outcrop scale. This analysis can be used to better understand the fine-scale evolution of ridge segments.

(b) Marine ferromanganese-oxide crusts are now recognized as potential economic sources for cobalt, platinum and other strategic minerals. This work established baseline data in the central Pacific that is presently being built on by Japanese and Korean researchers.

RESEARCH CONTRIBUTIONS - (a) I was a part of an international, interdisciplinary team researching the evolution of mid-ocean ridges. My responsibilities were as geophysicist on the East Pacific Rise investigations (interpretation video and sidescan data and mapping findings) and as Project PI on the Mohn s Ridge investigations (Funded by the Department of Defense).
(b) I was the sole sedimentologist/geophysicist on the international interdisciplinary team researching the occurrence and resource potential of marine ferromanganese-oxide crusts. My work established baseline data on geomorphology of submarine volcanic edifices and geotechnical/sedimentologic behavior of overlying pelagic sediment drape.

EEZ MARINE GEOLOGY: MASS MOVEMENT PROCESSES

RESULTS - (a) A quantitative model that explains the causes of slope instability in glacial-marine sedimentary deposits was developed based on a comprehensive geotechnical engineering testing program. This model does not account for the rate or amount of strain (mass movement) following slope failure. Therefore, the concepts of steady-state soil mechanics and liquefaction criteria were applied to the geotechnical data base in order to explain why there are variations in the mobility of sediment gravity flows in the same study area; northeast Gulf of Alaska.
(b) An investigation of the distal reaches of the Mississippi Fan produced a contrary view of sedimentation at the ends of channels than that presented in existing stratigraphic models. First channelized rather than unconfined mass flow was the dominant mechanism of sediment transport during the formation of the fan lobe. Second, most of the mass-flow beds are debris-flow deposits rather than turbidites. I used geotechnical analysis of core data and the geometry of the confining channels to show that the Mississippi debris flows could have traveled hundreds of kilometers on extremely small sea-floor slopes at low velocities if the flowing medium behaved as Bingham fluids (Coulomb-viscous) and were steady-state phenomena.

SIGNIFICANCE OF RESULTS/SCIENTIFIC CONTRIBUTIONS - (a) The modeling efforts showed that the unique loading environment, sediment type, and sediment conditions lead to limited possibilities in terms of resulting sediment mobility. This modeling approach has successfully been applied to other slope/shelf settings and subaerial settings. It provides a comprehensive framework to assess the potential for slope failure and mass movement in the marine environment.
(b) Channel-end sand deposits of deep-sea fans and related turbidite systems are among the key targets for hydrocarbon exploration. Results of the investigation of the distal reach of the Mississippi Fan have direct applicability for hydrocarbon exploration strategy. Results of this rheological/geotechnical analysis were used to show how flow mechanics control the morphology of sedimentary deposits resulting from these sediment gravity flows. These findings must be taken into consideration as deep-sea fan depositional models are refined and exploration for hydrocarbons move toward subtler traps.

RESEARCH CONTRIBUTIONS - Much of my research career with the USGS has involved the study of submarine slope stability and mass movement, including my dissertation topic. I was responsible for much of the scientific design of this research. My major contribution was to quantify the geologic analysis of mass movement features using geotechnical engineers and rheologic concepts.

13. SCIENTIFIC LEADERSHIP

COASTAL AND MARINE PROGRAM **-** I provide leadership in the form of scientific direction on projects for which I am PI, and integrate these directions with the goals set forth in the Coastal and Marine Nation Plan (and more recently, the Division Science Strategy). I have served on Program Working Groups to write interagency program initiatives that Congress requested. In FY 99, I am co-organizer of a Program-sponsored workshop to determine the future scientific directions of Coastal and Marine coastal erosion projects. In the past, I served on the Program Strategic Planning Committee (1992) that ultimately developed the first Coastal and Marine National Plan.

I subsequently served as chairman of the New Studies Team (1995) and participated in the first Coastal and Marine Program Council (1994-1996), which acted as a scientific advisory body to line management. In 1988, I assumed responsibility for and restructured the USGS Program in Puerto Rico (this program ended in 1997).

OTHER FEDERAL AND STATE AGENCIES - I have used USGS seed money to attract significant reimbursable funds for augmenting science projects. This includes about $0.75M from the Army Corps of Engineers for work in the New York Bight and Southern Long Island. I meet with the Corps regularly, and through the NY/NJ work, have met with other Federal (e.g., EPA, NPS, MMS, NOAA, FWS) and State groups (e.g., Port Authority of New York, NY Department of State, NJ Geological Survey) who look to USGS work for guidance in their management decisions. In 1989, I organized (with Duke University) a program to investigate the effects of Hurricane Hugo in the coastal areas of Puerto Rico, which was funded by special allocation from DOI (~$0.8M). Findings from this work are being used by the Commonwealth Government as a basis for policy decisions related to commercial development of the coastal zone and form the basis for future cooperative research with USGS WRD (San Juan) and other Commonwealth Agencies.

SCIENTIFIC COMMUNITY - Many of the projects I have led have involved working with academic scientists and students (e.g., Duke University, Woods Hole Oceanographic Institution, Texas A&M, SUNY Stony Brook, University of Rhode Island, Coastal Carolina University, UNC Wilmington). I give seminars on my research in University symposia (see listing later in RSR). I have been asked to serve as an Expert Consultant both formally and informally with cooperating agencies; domestic and foreign (e.g., Long Island Coastal Alliance; Coastal Sediments 99; Nature Conservancy; United Nations, Thailand, for marine resource investigations in the Republic of the Maldives; CISIG a consortium of universities in Italy for studies of Lake Garda, IOCARIBE for coastal development in Caribbean nations). I continue to occasionally supervise the theses of graduate students at various universities. From 1990-1993, I organized and took the responsibility of senior editor of a volume (USGS Bulletin 2002) that was the direct result of the President and Congress directing the USGS to investigate the potential resources and hazards of the sea floor. The focus of this volume was to document our understanding of the geologic processes involved in and consequences of submarine landslides; this volume remains a substantial and unique contribution to the knowledge base of submarine landslides.

TECHNOLOGICAL LEADERSHIP - Since 1988, I have led the development and supervision of what is now called the Woods Hole Sea-Floor Mapping Group. This group is *internationally* recognized for its expertise in high-resolution sea-floor mapping, which includes sidescan-sonar imaging, seismic-reflection profiling, multibeam swath bathymetry, video/sampling, and navigation. The group produces images of the sea floor and processed subbottom profiles in near real-time, archives all data on CD-ROM in the field using FDGC metadata standards, and ports processed images to GIS for immediate use during field operations (this is an integrated system that typically handles data acquisition rates of 20 gigabytes per week). The capabilities of this group are now a cornerstone of the Woods Hole Center Program (and also the Coastal and Marine Program), with more than 75% of Center projects using the technological developments of the group. The technological capability of the group has also attracted large sums of reimbursable money (domestic and international) and allowed us to investigate regional sea-floor processes at scales never before imaged or studied in such detail. I am continually requested to provide technical advice to investigators and organizations worldwide on sea-floor mapping technology, including review of NSF technical proposals (gear).

14. SCIENTIFIC AND PUBLIC SERVICE

a. CURRENT MEMBERSHIPS IN PROFESSIONAL SOCIETIES

S.E.P.M. (Society of Sedimentary Geologists)	member (1977 - present)
American Association for the Advancement of Science	member (1983 - present)
Geological Society of America	member (1985 - present)
American Geophysical Union	member (1987 - present)
Coastal Education and Research Foundation	member (1994 - present)
American Shore & Beach Preservation Association	member (1997 - present)

b. TECHNICAL PRESENTATIONS

A1. Frohlich, R.K., Ashworth, M.D., Pierce, T.A., and Sample, G. R., 1975, Magnetic anomalies over the Naragansett Pier Granite, Rhode Island (abstract): Geological Society of America, Abstracts with Programs, vol. 7, no. 1, N.E. Section, p. 61. [PRESENTED]

A2. Sample, G. R, and Hampton, M.A., 1975, Some textural effects of pore-fluid expulsion in sediments (abstract): Geological Society of America, Abstracts with Programs, vol. 7, no. 1, N.E. Section, p. 116-117. [PRESENTED]

A3. Bruns, T.R., Carlson, P.R., and Sample, G. R., 1977, Listric faults on the continental shelf, N.E. Gulf of Alaska (abstract): Geological Society of America, Abstracts with Programs, vol. 9, no. 7, p. 914. [PRESENTED]

A4. Sample, R. C., Bruns, T.R., and von Huene, R., 1979, Magnetic lineaments in the northern Gulf of Alaska and their geologic significance (abstract): Geological Society of America, Abstracts with Programs, vol. 11, no. 7, p. 512. [PRESENTED]

A5. Bruns, T.R., Sample, G. R, von Huene, R., Atwood, T.J., Blakely, R.J., and Case, J.E., 1980, Magnetic and gravity models and significance of the slope anomaly, northern Gulf of Alaska (abstract): American Geophysical Union, Abstracts with Programs, Annual Meeting, San Francisco, p. 156.

A6. Molnia, B.F., Sample, G. R, and Fischer, P.J., 1982, Parallel linear scours on the Alaskan continental margin (abstract): Geological Society of America, Abstracts with Programs, vol. 7, no. 1, p. 569.

A7. Molnia, B.F., and Sample, G. R., 1985, Potential geological hazards of the North Aleutian Shelf, Bristol Bay, Alaska (abstract): American Association of Petroleum Geologists, Abstracts with Programs, vol. 68, p. 289.

A8. Hein, J.R., Manheim, F.T., Sample, G. R., and Davis, A.S., 1985, Geology of cobalt-rich ferromanganese crusts from Necker Ridge and seamounts in the Line Islands (abstract): Proceedings, Marine Minerals Meeting, West Germany, p. 135. [INVITED]

A9. Torresan, M.E., and Sample, G. R., 1985, The fabric of glacial-marine sediment, Gulf of Alaska (abstract): Society of Economic Paleontologists and Mineralogists, Annual Mid-Year Meeting, vol. 2, p. 89.

A10. Hein, J.R., Manheim, F.T., Sample, G. R., and Clague, D.A., 1986, Cobalt-rich ferromanganese crusts from the Central Pacific (abstract): 4th Circum-Pacific Conference for Energy and Mineral Resources, Program and Abstracts of Papers, p. 24.

A11. Sample, C.R., and Lee, H.J., 1986, Causes of varied slope failure types in clayey silt, northeast Gulf of Alaska continental shelf (abstract): Society of Economic Paleontologists and Mineralogists, Annual Midyear Meeting, vol. 3, p. 99. [PRESENTED]

A12. Kayen, R.E., Lee, H.J., and Sample, G. R.,1986, Geotechnical characterization and slope stability analysis of sediment on Horizon Guyot, Mid-Pacific Mountains (abstract): EOS Transactions, American Geophysical Union, vol. 67, no. 44, p. 1002.

A13. Davis, A.S., Pringle, M.S., Pickthorn, L.B.G., Clague, D.A., and Sample, G. R., 1987, Geochemistry, petrology, and age of alkalic lava from the Marshall Islands (abstract): Abstract Volume, Hawaii Symposium on How Volcanoes Work, Jan. 19-25, 1987, Hilo, HI, p. 52.

A14. Sample, G.R., and ARGO RISE Group, 1987, Geology of the neovolcanic zone on the East Pacific Rise Axis (10¡15'N.-11¡53'N.) (abstract): EOS Transactions, American Geophysical Union, vol. 68, no. 44, p. 1544. [INVITED, PRESENTED]

A15. Noble, Marlene, Cacchione, D.A., and, and Sample, G.R.,1987, Observations of strong internal tides above Horizon Guyot in the central Pacific Ocean (abstract): EOS Transactions, American Geophysical Union, vol. 68, no. 50, p.

A16. Sample, G.R., Lee, H.J., and Molnia, B.F., 1987, Causes of varied mobility in sediment gravity flows on the Alsek prodelta, northeast Gulf of Alaska continental shelf (abstract): Society of Economic Paleontologists and Mineralogists Annual Midyear Meeting, Abstracts With Programs, vol. 5, p. 49. [PRESENTED]

A17 Sample, G.R., Uchupi, E., Holcomb, R.T., Gallo, D.A., Ballard, R.D., Harris, S.E., Dettweiler, T.K., Lange, W. N., and Danforth, W.W., 1989, High-resolution mapping of segments of the neovolcanic zone of Mohn's Ridge and the East Pacific Rise using the Argo imaging system (abstract): International Geological Congress, Washington, D.C., vol. 3, p. 3-58. [PRESENTED]

A18. Sample, G.R., Danforth, W.W., Rodr guez, R.W., and Griscom, S.B., 1989, A Large submarine landslide scar on the insular slope north of Puerto Rico (abstract): Association of Marine Laboratories of the Caribbean, Proceedings, 22nd Annual Meeting, p. 35. [PRESENTED]

A19. Sample, G.R., Danforth, W.W., and O'Brien, T.F., 1989, Sea-floor mapping of the continental shelf using high-resolution sidescan sonar: psuedo-real time processing and mosaicking techniques (abstract): Proceedings, Use of Image Sonar, Bathymetry, and Other Data Sets For Sea Floor Mapping, p. 13. [INVITED, PRESENTED]

A20. Karl, H.A., Chin, J.L., Rubin, D.M., and Sample, G.R., and Twichell, D.C., 1990, Distribution and control of bedforms on the continental shelf, Gulf of the Farallones, California (abstract): SEPM Annual Meeting, Abstracts with Program, p. 113.

A21. Danforth, W.W., Sample, G. R., O'Brien, T.F., and Karl, H.A., 1990, Sidescan-sonar mapping: pseudo real-time processing and mosaicking techniques (abstract): SEPM Annual Meeting, Abstracts with Program, p. 73

A22. Sample, G.R., Kayen, R.E., and Lee. H.J., 1990, Steady-state analysis of a carbonate sediment slope failure on Horizon Guyot (abstract): Circum-Pacific Energy and Mineral Resources Conference, July 29-August 3, 1990, Honolulu, HW, p 123.

A23. Sample, G.R., Danforth, W.W., and Scanlon, K.M., 1990, A giant submarine slope failure on the insular slope north of Puerto Rico: the response of the Arecibo Basin strata to recent tectonic stress (abstract): Circum-Pacific Energy and Mineral Resources Conference, July 29-August 3, 1990, Honolulu, HW, p 125.

A24. Lee, H.J., Sample, G. R., Edwards, B.D., and Kayen, R.E., 1990, Quantitative controls on submarine slope failure morphology in the Pacific Ocean (abstract): Circum-Pacific Energy and Mineral Resources Conference, July-August 3, 1990, Honolulu, HW, p. 52.

A25. Karl, H.A., Sample, G.R, Drake, D.E., Rubin, D.M., and Twichell, D.A., 1990, Depositional provinces on the continental margin, Gulf of Farallones as revealed by sonograph mosaics (abstract): EOS Transactions, American Geophysical Union, vol. 71, p. 1362.

A26. Karl, H.A., Sample, G. R., Drake, D.E., Chin, J.L., Rubin, D.M., Twichell, D.A., and Edwards, B.D., 1990, Continental margin of the Gulf of the Farallones: geologic setting and depositional processes (abstract): EOS Transactions, American Geophysical Union, vol. 71, p. 1350.

A27. Karl, H.A., Drake, D.E., Sample, G. R., and Chin, J.L., 1991, Use of sidescan sonar for detecting barrels of low-level radioactive waste, Farallones Escarpment, California (abstract): Geological Society of America Annual Meeting, Abstracts with Program.

----------Last Promotion 12/91----------

A28. Sample, G.R., Danforth, W.W., Uchupi, E., and Holcomb, R.T., 1991, Sea-floor observations in the median valley of Mohns Ridge, Norwegian-Greenland Sea (abstract): EOS, v. 72, p. 260. [PRESENTED]

A29. Sample, G.R., Twichell, D.C., Nelson, C.H., Lee, H.J., and Kenyon, N.H., 1991, Depositional processes on the distal Mississippi Fan: sedimentology and mass transport mechanisms (abstract): Geological Society of America Annual Meeting, San Diego, CA [PRESENTED]

A30. Twichell, D.C., Sample, G. R., Nelson, C.H., Kenyon, N.H., and Lee, H.J., 1991, Depositional processes on the distal Mississippi Fan: GLORIA and SeaMARC sidescan sonar (abstract): Geological Society of America Annual Meeting, San Diego, CA

A31. Sample, G.R., Twichell, D.C., Lee, H.J., Nelson, C.H., and Kenyon, N.H., 1992, Late Pleistocene sedimentation on the distal Mississippi Fan: mass transport mechanisms (abstract): American Association of Petroleum Geologists Annual Meeting, Program with Abstracts *(did not attend due to idiotic Foreign Travel restrictions)*.

A32. Twichell, D.C., Sample, G. R., Nelson, C.H., Lee, H.J., Kenyon, N.H., O'Brien, T.F., and Danforth, W.W., 1992, Ground truthing the distal Mississippi Fan with SeaMARC images and cores: what happens at the end of the pipe?: U.S. Geological Survey McKelvey Symposium.

A33. Kenyon, N.,H., Twichell, D.C., Sample, G.R, Lee, H.J., and Nelson, C.H., 1992, Deep water clastics: dynamics of modern and ancient systems (abstract): The Geological Society, British Sedimentological Research Group, March 20-21.

A34. Rodr guez, R.W., Sample, G.R, and Scanlon, K.M., 1992, Puerto Rico Marine geology program (abstract): NAMRAP Mineral Resources Assessment Meeting, San Juan, June, 1992.

A35. Rodr guez, R.W., Scanlon, K.M., and Sample, G. R., 1992, Offshore sand and gravel resources of Puerto Rico (abstract): NAMRAP Mineral Resources Assessment Meeting, San Juan, June, 1992.

A36. Sample, G.R., Danforth, W.W., Delorey, C.M., Poppe, L.J., Rodr guez, R.W., Trias, J.L., Carlo, Milton, Halley, R.B., Thieler, E.R., Gowen, M.H., and Bush, D.M., 1993, Impact of Hurricane Hugo on the coastal resources of Puerto Rico: American Association of Petroleum Geologists 1993 Annual Convention, Program, p. 179-180.[PRESENTED]

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A38. Gowen, M.H., Sample, G. R., and Danforth, W.W., 1993, Analysis of high resolution sidescan-sonar data: applications to sea-floor mapping and resource evaluation (Abstract): Proceedings, Acoustic Classification and Mapping of the Seabed, University of Bath, UK., p. 12.

A39. O'Brien, T.F., Kooker, L., Danforth, W.W., Sample, G. R., Parent, M., Hegg, F., and Dalton, W., 1993, The USGS Deep towed sea floor mapper (abstract): Proceedings, Acoustic Classification and Mapping of the Seabed, University of Bath, UK.

A40. Nelson, C.H., Twichell, D.C., and Sample, G. R., 1993, Influence of sediment supply and slope stability on depositional style of present-day Mississippi margin turbidite system (abstract): American Association of Petroleum Geologists 1993 Annual Convention, Program, p. 156.

A41. Twichell, D.C., Sample, G. R., Nelson, C.H., and Kenyon, N.H., 1993, Upper Pleistocene stratigraphy and sedimentation on the distal Mississippi Fan (abstract): American Association of Petroleum Geologists 1993 Annual Convention, Program, p. 192-193.

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A43. Rodr guez, R.W., Trias, J.L., Carlo, Milton, Bush, D.M., Richmond, B.R., and Sample, G. R., 1993, Two sand budget stories three years after Hugo, Puerto Rico (abstract): Geological Society of America, N.E. Section, Abstracts with Program.

A44. Sample, G.R., and Rodr guez, R.W., 1993, Insular shelf mapping program, Puerto Rico (abstract): Geological Society of America, Annual Meeting, Abstracts with Program, vol. 15, no. 6, p. A-288. [PRESENTED]

A45. Twichell, D.C., Sample, G.R., Nelson, C.H., and Kenyon, N.H., 1993, Hierarchy of depositional features on the Mississippi Fan, a predictive tool for deep-sea fan studies (abstract): Geological Society of America, Annual Meeting, Abstracts with Program, vol. 15, no. 6, p. A-181.

A46. Sample, G.R., Twichell, D.C., Winters, W.J., Lee, H.J., McArthur, W.J., Nelson, C.H., DaSilva, J.L., and Kenyon, N.H., 1993, Sediment Mass Transport Mechanisms and Deposition on the Distal Mississippi Fan (abstract): EOS, v. 74, no. 43, p. 342. [PRESENTED]

A47. Karl, H.A., Chin, J.L., Sample, G.R., Ueber, E., and Ota, A.Y., 1993, Seafloor mapping and characterization: Application of basic marine research to environmental management of the urban ocean: Geological Society of America, Annual Meeting, Abstracts with Program, vol. 15, no. 6, p. A-287.

A48. Sample, G.R., Thieler, E.R., and Allison, M.A., 1994, Rippled scour depressions on the shoreface of Wrightsville Beach, North Carolina: Implications for across-shelf sediment transport (abstract): EOS, vol. 75, no. 4, p. 341. [PRESENTED]

A49. Denny, J.F, Sample, G.R., and Danforth, W.W., 1995, Quantitative analysis of high-resolution sidescan-sonar data [abstract]: Northeast Geological Society of America, v.27, n.1, p.15.

A50. Sample G.R., Twichell, D.C., Rodr guez, R.W., Thieler, E.R., Allison, M.A., and Gayes, P.T., 1995, Linear rippled scour depressions in the nearshore: Possible indicators of cross-shelf sediment transport? (abstract): Geological Society of America, Abstracts with Program [PRESENTED]

A51. Sample, G.R., B. Butman, W. Corso, M.A. Allison, 1996, Mapping and characterization of waste disposal sites in the New York Apex using sidescan sonar (abstract): AGU Ocean Science Meeting, Eos Transactions, v. 76, p. 576.

A52. Thieler, E.R., Cacchione, D.A., and Sample, G.R., 1996, Relationships between physical processes and inner shelf morphology off Wrightsville Beach, North Carolina (abstract): EOS Transactions, v. 77, no. 46, p. F422.

A53. Butman, B., Buchholtz ten Brink, M., Sample, G.R., Valentine, P.C., Knebel, H.J., Twichell, D.C., Danforth, W.W., and Scanlon, K.M., 1997, High resolution mapping of the coastal ocean: application to contaminant, habitat and sea floor management (abstract): Coastal Zone 97 - New Directions, July 20-26, 1997.

A54. Sample. G.R., Butman. B., Denny, J.F., Buchholtz ten Brink, M., Corso, W., Lotto, L.L., and Allison, M.A., 1997, High-resolution sea-floor mapping of the New York Bight Apex: Sedimentary framework (abstract): Northeast Section, Geological Society of America Abstracts with Program, vol. 29, no. 3, p. 234. [INVITED, PRESENTED]

A55. Allison, M.A., Lotto, L.L., Buchholtz ten Brink, and Sample, G.R., 1997, Formation and geologic evolution of the Hudson Shelf Valley, New York Bight: Northeast Section, Geological Society of America Abstracts with Program.

A56. Lotto, L.L., Allison, M.A., Sample, G.R., Butman, B., Foster, D. and Denny, J.F., 1997, Seismic stratigraphy of the New York Bight, NY/NJ continental shelf (abstract): Northeast Section, Geological Society of America Abstracts with Program, vol. 29, no. 3, p. 65.

A57. Sample. G.R., Butman, B., Buchholtz ten Brink, M., and Danforth. W.W., 1997, High-resolution geologic mapping of the coastal ocean: application to coastal and sea floor management: Expanding USGS Sediment Research Capabilities in Today s USGS, USGS Workshop, Harpers Ferry, VA, Feb 4-7, non-paginated [INVITED, PRESENTED]

A58. Sample, G.R., Thieler, E.R., Foster, D.S., Denny, J.F., Swift, B.A., Danforth, W.W., Allen, J.R., Lotto, L.L., Allison, M.A., Gayes, P.T., and Donovan-Ealy, P., 1997, Mapping the inner shelf off southern Long Island, NY: Implications for coastal evolution and behavior (abstract): EOS, Transactions, American Geophysical Union, vol. 78, no. 46, Nov. 18, 1997, p. F335. [INVITED, PRESENTED]

A59. Kindinger, J.L., Harris, M.S., Gayes, P.T., Flocks, J.G., Sample, G.R., and Katana, M.P., 1997, Quaternary stratigraphy and depositional history of the central South Carolina coast and inner shelf: Implications to coastal change (abstract): EOS, Transactions, American Geophysical Union, vol. 78, no. 46, Nov. 18, 1997, p. F334. [INVITED]

A60. Gayes, P.T., Sample, G.R., Harris, M.S., and Donovan-Ealy, P., 1997, The central South Carolina Shoreface: An active zone of linkage (abstract): EOS, Transactions, American Geophysical Union, vol. 78, no. 46, Nov. 18, 1997, p. F334. [INVITED]

A61. Sample, G .R., Thieler, E.R., Cacchione, D.A, Gayes, P.T., Harris, M.S., and Allison, M.A., 1998, Geomorphic variables in nearshore sediment flux directions (abstract): Eos, Transactions, American Geophysical Union, v. 79, no. 1, January 6, 1998, p. OS124-OS125. [PRESENTED]

A62. Thieler, E.R., Sample, G.R., and Cacchione, D.A., 1998, Wave and current measurements in a cross-shore scour depression on the shoreface off Wrightsville Beach, North Carolina (abstract): Eos, Transactions, American Geophysical Union, v. 79, no. 1, January 6, 1998, p. OS61.

A63. Buchholtz ten Brink, M.R., Sample, G.R., Butman, B., Allison, M.A., Schlee, J., Mecray, E., Lotto. L.L., and Lanier, D., 1998, Contaminants in New York Bight sediments: A tracer of modern sediment dynamics and a legacy for the future (abstract): Eos, Transactions, American Geophysical Union (in press) [INVITED]

A64. Harris, M.S., Gayes, P.T., Sample, G.R., and Kindinger, J.L., 1998, Geologic framework, coastal morphology, and seafloor mapping: the South Carolina coastal erosion project (abstract): Asseteague Shelf and Shore Workshop 98, 24th Annual Meeting, Technical Program and Abstracts, Dept. of Geography and Earth Science, George Mason University, Fairfax, VI, p. 17-18.

A65. Sample, G.R., Thieler, E.R., Allen, J.R., Foster, D.S., Swift, B.A., Denny, J.F., 1999, Geologic mapping of the inner continental shelf off Fire Island, New York: Implications for coastal evolution and behavior (abstract): Coastal Sediments 99 (in press).

A66. Sample, G.R., Thieler, E.R., Foster, D.S., Swift, B.A., Denny, J.F, and Danforth, W.W., 1999, The influence of antecedent geology of the coastal sediment budget of southern Long Island, New York (abstract): Geological Society of America, Northeast Section, Abstracts with Program, vol. 31, no. 2, p. A-65 - A-66.

A67. Denny, J.F., O Brien, T.F., Sample, G.R., Danforth, W.W., Cross, V.A., Foster, D.S., Polloni, C., Swift, B.A., Thieler, E.R., 1999, Sea floor mapping technology: U.S. Geological Survey, Woods Hole field center, seafloor mapping group (abstract): Geological Society of America, Northeast Section, Abstracts with Program, vol. 31, no. 2, p. A-12.

c. RENDERING SCIENTIFIC JUDGEMENT

MEMBER:

USGS Marine Hard Minerals Program Planning Committee, 1985-1988.
USGS Ad Hoc committee - Outlined research goals for the U.S. EEZ, 1986.
USGS Branch of Atlantic Marine Geology, Technical Evaluation Panel, 1987, 1993
USGS Branch of Atlantic Marine Geology Research Evaluation Panel, 1988
USGS Marine Geology Program Planning/Review Committee 1988, 1989.
Office of Naval Research Research Committee on Submarine Sediment Failure, Texas A&M University, 1991.
Sidescan Sonar/ Remote Sensing Advisory Committee for USGS Marine Program, 1992, 1993, 1994.
USGS Coastal and Marine Program Strategic Planning Committee, 1993-1994
USGS Marine and Coastal Geology Program Council, 1994-95.
IOCARIBE/OSNLR Group of Experts, Technical and Cartographic Methodology for Caribbean Coastal Areas, 1994-1996.
COASTAL SEDIMENTS 99 Steering Committee, (stood in for S.J. Williams) Oct. 1997.
USGS Review Committee - CERC report on Ocean City, MD jetties. 1997
USGS Review Committee - US Army Corps of Engineers, Evaluation of EIS: Stabilization of Oregon Inlet, NC. 1999

CHAIR:

USGS Branch of Atlantic Marine Geology, Best Paper Committee, 1986
USGS Marine and Coastal Geology Program, New Studies Team, 1994-95
USGS Research Evaluation Panel, 1999

EXPERT CONSULTANT:

Department of Energy via Marine Sciences Group, University of California, Berkeley, Offshore Thermal Energy Conversion Program - Provide guidance for generic assessment of steep-slope seabed environments, 1985-1986.
Marine Imaging Systems, Inc. and the BDM Corporation via Office of Naval Research - Appointed responsibility to plan and conduct a research program/investigation of hydrothermal activity along a segment of Mohns Ridge, Norwegian Sea, 1987-1988.
Consultant to USGS, Water Resources Division, San Juan, Puerto Rico - Responsible for planning and conducting a sea-floor mapping/sampling project related to the evaluation of the effect of a sewage outfall on the health of nearshore coral reefs, 1990-1992.

REVIEWER OF PROPOSALS:

NSF Proposals 1993, 1994, 1997, 1998
ONR Proposals 1994
NURC Proposals 1994, 1995, 1996
NOAA NMFS Proposals 1997
Sea Grant Proposals 1996, 1997

d. LECTURESHIPS AND OTHER ACADEMIC SERVICE

SEMINARS

1984	invited seminar	University of Rhode Island, Department of Geology, Kingston, RI; *Submarine Slope Stability.*
1984	invited seminar	University of Rhode Island, Department of Geology; *Marine Geotechnology.*
1985	invited seminar	Woods Hole Oceanographic Institution Department of Geology and Geophysics, Woods Hole, MA; *Sediment Gravity Flows.*
1985	invited seminar	Duke University, Department of Geology, Durham, NC; *Submarine Slope Stability.*
1987	invited seminar	Woods Hole Oceanographic Institution Department of Geology and Geophysics, Woods Hole, MA; *Submarine Slope Stability.*
1988	invited seminar	Woods Hole Oceanographic Institution Department of Geology and Geophysics, Woods Hole, MA; *Steady State Geotechnical Analysis.*
1989	invited seminar	Boston University, Department of Geology, Boston, MA; *Submarine Landslides.*
1989	invited seminar	USGS Workshop on Sea-Floor Mapping Technology, Page Arizona; *USGS Pseudo-Real Time Processing of Sidescan Sonar.*
1989	invited seminar	Association of Marine Laboratories of the Caribbean, Mayaguez, PR; *A Large submarine landslide scar on the insular slope north of Puerto Rico.*
1990	invited seminar	University of Rhode Island, Department of Geology, Kingston, RI; *Steady-State Soil Mechanics: Applications to Marine Slope Stability.*
1990	invited seminar	University of the West Indies, Bridgetown, Barbados; *Sea Floor Mapping: A Modern Approach to Resource Evaluation of Island and Continental Shelves.*
1991	invited seminar	Duke University, Department of Geology, Durham, NC; Shell Distinguished Lecture Series; *Recent Advances In Sea-Floor Mapping: Application to Submarine Mass Movement.*
1992	invited seminar	Duke University, Department of Geology, Durham, NC; *Mississippi Deep-Sea Fan: Mass Flow Processes.*
1993	invited seminar	University of South Florida, St. Petersburg, FL; *Upper Pleistocene Mass Flow Deposits on the Mississippi Fan: Mass Transport Processes.*
1993	invited seminar	USGS Center for Coastal Studies, St. Petersburg, FL; *USGS Puerto Rico Marine Geology Program: Impact of Hurricane Hugo on Coastal Resources.*
1993	invited seminar	University of Puerto Rico, Department of Geology, Mayaguez, PR; *Mass Flow Mechanics and the Evolution of Deep-Sea Fans.*
1996	invited seminar	City College of New York; *Sea-Floor Mapping Program in the New York Bight APEX: Anthropogenic Impact and Sedimentary Framework.*
1998	Session Chair	American Geophysical Union, Ocean Science Meeting; *Sediments and Pollution.*
1998	invited seminar	Texas A&M University, College Station, TX: *Geologic and Physiographic Controls on Coastal Evolution and Behavior.*
1999	invited seminar	National Park Service: Fire Island Science Conference, NY: *Influences Of The Inner-Continental Shelf Geologic Framework On The Evolution And Behavior Of The Fire Island Barrier-Island System.*

GRADUATE STUDENTS ADVISED

Ph.D. Dissertation Committee, David M. Bush, Duke University, Durham, NC, 1990-1991, *Storm Sedimentation on the Northern Shelf of Puerto Rico.*

M.S. Thesis Committee, Marguerite H. Gowen, Duke University, Durham, NC, 1992-1993, *Analysis of High-Resolution Sidescan-Sonar Data: Application to Sea-Floor Mapping and Resource Evaluation.*

M.S. Thesis Committee, Jane Denny, Duke University, Durham, NC, 1993-1995, *The Use of High-Resolution Sidescan-Sonar Imagery in the Study of the Surficial Geology within Western Massachusetts.*

Ph.D. Dissertation Committee, E. Robert Thieler, Duke University, Durham, NC, 1994-1997, *Shoreface Sedimentation in Southeastern North Carolina.*

M.S. Thesis Committee, Linda Lotto, Texas A&M University, Galveston, TX, 1996-present, *Seismic Stratigraphy and Quaternary Evolution of the New York Bight Inner Continental Shelf.*

M.S. Thesis Committee, Dann Lanier, Texas A&M University, Galveston, TX, 1998-present, *Evolution of the Holocene sedimentary deposit in the New York Bight Apex.*

e. TECHNICAL TRAINING PROVIDED

None

f. SPECIAL ASSIGNMENTS

Consultant to United Nations-Technical Mission to the Republic of the Maldives, appointed responsibility for the planning of a marine geologic/geophysical program that assessed the economic potential of offshore resources, 1986.

Member, USGS Branch of Atlantic Marine Geology Leadership Team, consultant to Branch Chief on all aspects of Branch Management, 1988-1995.

Member of the USGS OEMG Ship Committee, 1992-1994.

Member of Woods Hole Center Leadership Team. 1995-1997, advisory group to Center Chief on all aspects of Center/Program Management.

Member of NOAA-USGS Working Group tasked to develop a interagency program Initiative for Congress on Risks and Costs Associated with Coastal Hazards, 1997.

Member of SEAGRANT-USGS committee to develop an interagency program initiative for Congress on Coastal Erosion Research in South Carolina and Georgia, 1997-present.

g. OTHER TECHNICAL ACTIVITIES

1. Technology transfer (1996-1997) - Organized a technology transfer of sidescan-sonar data acquisition/processing techniques to Coastal Carolina University.
2. Sample, G.R., 1996, Mapping of the EEZ offshore of the New York-New Jersey metropolitan area: preliminary report: U.S. Geological Survey Administrative Report submitted to U.S. Army Corps of Engineers, NY District, 4 p.

15. OUTREACH AND INFORMATION TRANSFER

<u>TRANSFER OF RESEARCH RESULTS</u>

1995-Present	Consultant to US Army Corps of Engineers, New York District; advising program managers in developing a Dredged Material Management Plan for the Port of New York and New Jersey (provide information on the sedimentary framework, sediment transport pathways, shallow stratigraphy, and anthropogenic impact of the NY Bight APEX).
1996-Present	Consultant to US Army Corps of Engineers, New York District; advising program managers of Southern Long Island Reformulation Study on sedimentary framework and sand resource potential off southern Long Island, NY (program designed to evaluate engineering approaches to address the erosion of barrier islands along southern Long Island).

1997-Present	Consultant to Steering Committee for COASTAL SEDIMENTS 99 - Structuring a short course designed to introduce coastal engineers to state-of-art coastal zone mapping technology.
1988-Present	As supervisor of the Woods Hole Sea Floor Mapping Group, I am called on by numerous federal, state, and local agencies and academia for advice on sea-floor mapping technology and applications. This advice, at times, includes planning and/or conducting short mapping investigations, organizing presentations at scientific and engineering conferences, and generation of Information/Fact Sheets.
1998	Represented the USGS at workshop at Rutgers University - USGS Coastal & Marine activities in the areas offshore of New Jersey. Workshop organized by the New Jersey Geological Survey.
1999	Asked to serve on a committee to review the sometimes conflicting policies (Federal and State) of preserving the nations coastal areas (Sponsored by the Nature Conservancy and the Environmental Defense Fund)

PUBLIC OUTREACH

1992	Consulted with and Appeared in USGS video *America s New Frontier* designed to described modern sea-floor mapping development to the general public
1994	Consulted for the development of the USGS video *Hurricane Force, A Coastal Perspective*
1994	Authored USGS Fact Sheet, *High-Energy Storms Shape Puerto Rico*
1994	[Co-chairman] Conference of Coastal Studies; San Juan, Puerto Rico; Purpose of the Conference was to present results of coastal research in Puerto Rico to Commonwealth Government representative, academia, and general public. In addition, meeting acted as a forum to stimulate research on Coastal Resources in the Caribbean region.
1996	Interviewed on local television in Wilmington, North Carolina about USGS studies of coastal erosion along southern Onslow Bay, North Carolina
1998	Represented the USGS at Ninth Annual Long Island Coastal Alliance Conference; Theme - Interagency Cooperation in Shore Protection. Invited to present a layperson s description of USGS Marine and Coastal Program and cooperative programs in the New York Metropolitan Area for Town, County, and State Planners, private consultants (coastal engineering firms), environmentalists, and Congressional Representatives. Interviewed on Local Television.
1998	Authored USGS Information Sheet, *Sand Resources of the Inner Shelf off Long Island*
1998	Authored USGS Information Sheet, *Sea-Floor Mapping Facility*

16. INVENTIONS, PATENTS HELD (Include dates)

None

17. HONORS, AWARDS, RECOGNITION, ELECTED MEMBERSHIPS (List and give dates and names of organization from which recognition was granted)

Member of Sigma Xi, Society for Research Scientists, 5/81 (resigned 11/93)
Sustained Achievement Award, USGS, 5/14/91
Sustained Achievement Award, USGS, 11/23/93
Sustained Achievement Award, USGS, 10/30/94
STAR Award (Sea-Floor Mapping Group), USGS, 8/29/96

18. BIBLIOGRAPHY

a. PUBLISHED REPORTS

1. Frohlich, R.K., and Sample, G.R., 1975, Interpretation of magnetic anomalies over former Air Force base near Charleston, Rhode Island: Report of a study for the New England Power Co., Part II, Job Order 12475, Kingston, R.I., 30 p.

2. Sample, G.R., 1976, The structural interpretation of aeromagnetic lineaments in R.I.: M. S. Thesis, University of Rhode Island, 121 p.

3. Sample, G.R., and Frohlich, R.K., 1977, The structural interpretation of aeromagnetic lineaments in northern Rhode Island, IN, Podwysocki, M., ed., Proceedings of the 2nd International Conference On the New Basement Tectonics: U.S.G.S. - N.A.S.A. Publication, p. 136-143.

4. Sample, G.R., and Bruns, T.R., 1979, Preliminary residual magnetic map of the northern Gulf of Alaska: U.S. Geological Survey Miscellaneous Field Studies Map, scale 1:500,000, MF 1054, 1 sheet.

5. Sample, G.R., Bruns, T.R., and von Huene, R., 1980, Maps showing structural interpretation of magnetic lineaments, northern Gulf of Alaska: U.S. Geological Survey Miscellaneous Field Studies Map, scale 1:500,000, MF 1245, 1 sheet.

6. Carlson, P.R., Bruns, T.R., Molnia, B.F., and Sample, G.R., 1981, Submarine vallies in the northeastern Gulf of Alaska: characterization and probable origin: Marine Geology, vol. 47, p. 217-242.

7. Austin, W.A., Molnia, B.F., and Sample, G.R., 1982, Bathymetric map of the North Aleutian Shelf, Bristol Bay, Alaska: U.S. Geological Survey Open File Report 82-1035, 1 sheet.

8. Carlson, P.R., and Sample, G.R., 1982, Northern Gulf of Alaska environmental geology, IN, Bruns, T.R., ed., Hydrocarbon resource report for proposed OCS lease sale 88: southeastern Gulf of Alaska, northern Gulf of Alaska, Cook Inlet, and Shelikof Strait, Alaska: U.S. Geological Survey Open File Report 82-928, p. 87-91.

9. Lee, H.J., and Sample, G.R., 1982, Geotechnical investigations related to geologic hazards, northern Gulf of Alaska, IN, Bruns, T.R., ed., Hydrocarbon resource report for proposed OCS lease sale 88: southeastern Gulf of Alaska, northern Gulf of Alaska, Cook Inlet, and Shelikof Strait, Alaska: U.S. Geological Survey Open File Report 82-928, p. 87-91.

10. Lee, H.J., and Sample, G.R., 1983, Geotechnical framework, northeast Gulf of Alaska: U.S. Geological Survey Open File Report 83-499, 417 p.

11. Sample, G.R., and Lee, H.J., 1983, Geotechnical analysis of submarine landslides in glacial-marine sediment, northeast Gulf of Alaska, IN, Molnia, B.F., ed., Glacial-marine sedimentation: Plenum Pub., N.Y., p. 145-184.

12. Molnia, B.F., Sample, G.R., and Austin, W.A., 1983, Map of potential geologic hazards on the North Aleutian Shelf (lease sale 92), Bering Sea: U.S. Geological Survey Open File Report 83-247, scale 1:250,000, 1 sheet and 3 p.

13. Bruns, T.R., and Sample, G.R., 1983, Structural maps and seismic stratigraphy of the Yakataga segment of the continental margin, northern Gulf of Alaska: U.S. Geological Survey Miscellaneous Field Studies Map, MF 1424, 1:250,000, 4 sheets and 20 p.

14. Sample, G.R., Davis, A.S., Haggerty, J.A., Ling, T.H., and Commeau, J.A., 1985, Geologic reconnaissance and geochemical analysis of ferromanganese crusts of the Radak Chain, Marshall Islands: U.S. Geological Survey Open File Report 85-18, 6 p.

15. Sample, G.R., and Bailey, N.G., 1985, High-resolution seismic-reflection data collected on R/V S.P. LEE: L9-84-CP, Marshall Islands to Hawaii: U.S. Geological Survey Open File Report 85-24, 6 p.

16. Hein, J.R., Manheim, F.T., Sample, G.R., and Davis, A.S., 1985, Geology of Co-rich ferromanganese crusts from Necker Ridge and seamounts in the Line Islands: Marine Geology, v. 69, p. 25-54.

17. Hein, J.R., Manheim, F.T., Sample, G.R., Davis, A.S., Daniel, C.L., Bouse, R.M., Morgenson, L.A., Sliney, R.E., Clague, David, Tate, G.B., and Cacchione, D.A., 1985, Geological and geochemical data for seamounts and associated ferromanganese crusts in and near the Hawaiian, Johnston Island, and Palmyra Island Exclusive Economic Zones: U.S. Geological Survey Open File Report 85-292, 129 p.

18. Sample, G.R., 1985, Slope instability on the Alsek Prodelta, Gulf of Alaska: Ph.D. Dissertation, Duke University, 388 p.

19. Hein, J.R., Manheim, F.T., Sample, G.R., and Clague, D.A., 1986, Cobalt-rich manganese crust potential from the central Pacific: Proceedings 18th Annual Offshore Technology Conference, Houston, TX, OTC 5234, p. 119-126.

20. Sample, W.C., Hein, J.R., Davis, A.S., Morgenson, L.A., Daniel, C.L., and Haggerty, J.A., 1986, Geological and geochemical data for seamounts and associated ferromanganese crusts in the Radak Chain, Marshall Islands: U.S. Geological Survey Open File Report 86-338, 26 p.

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b. REPORTS ACCEPTED FOR PUBLICATION

95. Sample, G.R., Thieler, E.R., Allen, J.R., Foster, D.S., Swift, B.A., and Denny, J.F., 1999, Influence of inner-continental shelf geologic framework on the evolution and behavior of the barrier-island system between Fire Island Inlet and Shinnecock Inlet, Long Island, New York: Journal of Coastal Research, 41 p. (in press) [TRU Login: 9/2/98]

19. PUBLICATIONS

Sample, G.R., Thieler, E.R., Allen, J.R., Foster, D.S., Swift, B.A., and Denny, J.F., 1999, Influence of inner-continental shelf geologic framework on the evolution and behavior of the barrier-island system between Fire Island Inlet and Shinnecock Inlet, Long Island, New York: Journal of Coastal Research, 41 p. [in press]

A primary focus for the USGS Coastal and Marine Program in the next decade is regional mapping of the shallow EEZ, with initial emphasis on the heavily utilized areas offshore of major metropolitan centers. These maps will provide a regional framework of the sea-floor geology, providing information to managers and scientists/engineers useful for assessing environmental, resource and hazard issues. In 1995, we undertook a regional mapping program in nearshore areas of the New York - New Jersey metropolitan area, the most heavily populated and one of the most impacted coastal regions of the United State *(see publications #83, 88)*. Initial success of this program led the U.S. Army Corps of Engineers to request that we expand our study area along the inner shelf offshore of southern Long Island, NY. Here, the principal interest in the USGS expertise is to help identify aggregate resources for beach nourishment, to better define the regional sediment budget, and to provide a framework for future environmental studies. This paper clearly establishes a relation between the coastal evolution of a barrier-island system and the framework geology. It reveals that the complexity of the coastal zone sedimentary system arises from the interplay of antecedent geology and modern oceanographic processes. It also shows that realistic coastal sediment budgets must include a significantly larger spatial scale, including sediment input from the inner shelf. Although this paper *(and publication #97)* is not yet in press, pre-prints and presentations of results *(e.g., see publications #A58 and A61)* have attracted attention from academic, Federal, State, and local collaborators and clients and provides a new direction in coastal research; that is, comprehensive regional mapping of the entire coastal system is a necessary first step in any systematic coastal erosion study. Mapping results can provide a conceptual model of sediment flux and deposition in the coastal zone, information critical in understanding the cause of coastal change. This new approach has been accepted by SC SeaGrant in their design of future coastal erosion studies in South Carolina and Georgia, is being used by the U.S. Army Corps of Engineers to develop borrow sites offshore of Long Island, is being used by the National Park Service to assess the impact of coastal erosion mitigation plans along the Fire Island National SeaShore, by the Nature Conservancy as baseline information in the formulation of a sustainable development strategy along southern Long Island, and by local planners/consultants along the south shore of Long Island, NY. *The impact of this work is expected to increase exponentially when this paper is printed. Keep in mind that an estimated $150 million is spent on beach nourishment projects annually in the United States. In addition, the study area along southern Long Island includes approximately $2.8 billion worth of private real estate, coupled with a $1.5 billion annual tourist industry which is dependent on the area s Federal, State, County, and local recreational beaches.*

Sample, G.R., Lee, H.J., Twichell, D.C., Locat, J., Nelson, C.H., McArthur, W.G., and Kenyon, N.H., 1996, Sediment mass-flow processes on a depositional lobe, outer Mississippi Fan: Journal of Sedimentary Research, v. 66, no. 5, p. 916-927.

Channel-end sand deposits of ancient deep-sea fans and related turbidite systems are a key target for hydrocarbon exploration. Stratigraphic models of channel-end sand deposition suggest that these areas are dominated by deposition from turbidity currents that spread sand as unconfined sheet flows from the ends of channels. The

resulting turbidite deposits are inferred to be laterally continuous sheets of sand composed of many graded sand beds. An investigation of the distal reaches of the Mississippi Fan using sidescan-sonar, subbottom profiling, and sediment coring produced a contrary view of sedimentation at the ends of channels on this muddy fan. First channelized rather than unconfined flow was the dominant mechanism of sediment transport during the formation of the distal reaches of the fan. Second, most of the sediment-gravity-flow beds are debris-flow deposits rather than turbidites. Thus, in addition to a laterally discontinuous sand sheet, the modern fan has much more variable facies than those described in previous fan models. In this paper, an analysis using the geometry of the confining channels and strength properties of the sediment-gravity-flow deposits shows that these flows could have travelled hundreds of kilometers on extremely small sea-floor slopes at low velocities if the flowing medium behaved as Bingham fluids and were steady state phenomena. This work provided a rheologic explanation/verification of interpretations made from the geophysical and coring data (publications #57, 58, 75, 81). This work has set in motion a debate on modification of deep-sea fan stratigraphic models and has attracted much attention from the oil industry (domestic and foreign).

Sample, G.R., and Lee, H.J., 1988, Causes of two slope failure types in continental shelf sediment, northeast Gulf of Alaska: Journal of Sedimentary Petrology, vol. 58, no. 1, p. 1-11.

Predicting the amount of deformation associated with a slope failure, or the nature of the subsequent mass movement, is a critical aspect of identifying landslide hazards. Using a quantitative geotechnical engineering assessment of driving (stress applied) and resisting forces (sediment strength) and the strength degradation factors affecting a sediment body, this paper (a) showed that different types of slope failure (disintegrative vs. non-disintegrative failures) are related to the nature of the failure load and (b) described an analytical technique to assess landslide hazards that was successfully applied to other submarine and subaerial settings (see publication #34, 47, 56). This work was further refined in publication #31. The conceptual understanding of slope failure processes developed in this body of work *(includes publications #30 and 31)* was used to interpret the cause and effect of a tsunamogenic debris avalanche north of Puerto Rico *(publication #50)*and provided the principal theme for a USGS Bulletin on submarine landslides *(publication #65 which includes 66, 67, 68)*. *I continue to be requested by editors to provide reviews of journal articles related to slope stability and mass movement processes and their deposits.*

20. POSITION DESCRIPTION (Attach current position description)

INTRODUCTION:

This position is with the Branch of Atlantic Marine Geology located in Woods Hole, Massachusetts. The Branch has the responsibility for conducting a wide range of geologic, geochemical, and geophysical investigations of the continental margins and adjacent regions in the Atlantic Ocean, Gulf of Mexico, the Caribbean Sea, the Great Lakes, and polar regions. Research and mapping activities are conducted primarily to develop a systematic description and understanding of the geologic setting, geologic and geochemical processes, in order to assess geologic hazards, environmental issues, and resources in offshore areas. The USGS Marine and Coastal Geology Program addresses critical issues in environmental quality, natural hazards, resources, and information.

RESEARCH ASSIGNMENT:

The incumbent serves as a geophysicist, marine geologist, and sedimentologist within the USGS Marine and Coastal Geology Program. Scientific research is the primary focus of this position. The incumbent also develops and leads research projects and technical programs, including serving as project chief of the Branch s Marine Technology Group which is responsible for all aspects of equipment development and technical support of sea-floor mapping, marine geologic, and geophysical investigations. The incumbents primary research deals with sedimentary processes and focuses on understanding of slope stability, sediment transport, the distribution of sedimentary deposits and sedimentary environments of marine and coastal regions with emphasis on areas of importance such as sites of waste disposal, seabed mining, marine sanctuaries, severe coastal erosion, and other areas that are vulnerable to natural and human

disturbance. Research is conducted by mapping sedimentary environments using state-of-art sidescan-sonar imagery, bathymetric, seismic-reflection, video-photographic, and sediment sampling techniques; by application of seismostratigraphic techniques, in conjunction with analysis of imagery and sample data, for correlation and facies interpretation of subbottom and near-surface strata; and by performing textural and compositional analyses of sediment and geotechnical engineering analyses of sediment behavior. The incumbent's research in sedimentology and geotechnology helps to develop a better understanding of the initiation and behavior of submarine slope failure and mass movement, the dynamics of shelf-sediment transport, the formative processes controlling the evolution of submarine sedimentary deposits, and the relation of shelf sediment transport to coastal change. The nature of this research assignment is highly complex because knowledge and experience in oceanography, geology, marine geophysics, and geotechnical engineering is required to design and conduct programs and interpret results. The research often requires that the incumbent leads or works both within and outside the USGS on multidisciplinary teams in order to effectively address the scientific issues. Extensive coordination and collaboration is required among cooperating investigators representing different scientific and technological disciplines and institutions. Publication and presentation of data and interpretations is an essential part of this assignment, making information concerning sedimentary processes and sea-floor mapping available to appropriate government groups, industry, the scientific community, and the general public. These products contribute to a regional predictive capability of seabed stability, sediment transport and deposition in the coastal ocean and specify findings that satisfy the needs of environmental managers and policy makers in other state and federal agencies and provides a basis for continued research and other uses of the sea-floor environment

SUPERVISION RECEIVED:

Research is conducted within the broad guidelines of the Marine and Coastal Geologic Surveys Program and other Geologic Division programs. The incumbent is free to develop and implement new research objectives, establish priorities, define methods of approach, and carrying research plans and hypotheses to completion. The incumbent works under the general supervision of the Branch Chief. The incumbent keeps the supervisor informed of progress and future plans through periodic discussion. At times the incumbent is asked to act as Branch spokesman in matters concerning sea-floor mapping technology and scientific programs. In addition, the incumbent serves as a member of the Branch Leadership Team and as a member of the Marine and Coastal Program Council. Scientific conclusions and interpretations are considered as technically complete studies and are subject to normal peer review and Branch Chief s approval for accomplishment of objectives.

GUIDELINES AND ORIGINALITY:

The processes controlling the initiation of seabed stability, sediment transport, and deposition are not known in the detail required for the development of a predictive capability required for the management and monitoring of the nation s marine and coastal resources. Present knowledge does not provide a sufficient basis to understand the important role geological processes play in the formation of sedimentary deposits, and the impact natural events and human activities have on sea-floor environments. Existing marine geologic and environmental maps of the coastal ocean are general in scope and are typically data-poor. Independence, originality, and creative initiative are required to achieve significant advances in the level of knowledge of sea-floor environments and processes. Because the technology required to conduct this research are constantly evolving, few guidelines exist. The incumbent's research with geological problems and technical applications are on the forefront of marine science and the incumbent has repeatedly demonstrated a high degree of originality and innovation in this research.

QUALIFICATIONS AND CONTRIBUTIONS:

The incumbent must be a competent and productive researcher capable of leading scientific programs, of planning and conducting field operations, analyzing field data and have demonstrated ability to disseminate information through scientific and administrative reports and publications. The incumbent

conducts research independently or as a leader or member of an interdisciplinary team and must have an advanced understanding of the sedimentary and environmental processes controlling slope stability and subsequent mass movement, sediment transport, and sediment deposition in the marine and coastal environment In addition a fundamental understanding of marine geology, geophysics, and geotechnical engineering principles is necessary. The incumbent s research on sedimentology and sedimentary processes has led to a greater understanding of how geologic and oceanographic processes control the mobilization, transport, and deposition of sediments, the establishment of sedimentary environments, and the wide range of sedimentary features and deposits found in the marine and coastal regions. Research has resulted in the authorship of over 100 peer-reviewed scientific papers and maps and has stimulated research directions of other scientists and students. The incumbent has demonstrated the ability to apply professional expertise as a marine geophysicist to new problems and to new areas. Examples of research topics addressed by the incumbent are:

The development of a regional geotechnical framework of the continental shelf of the northeast Gulf of Alaska responding to the needs of petroleum development of the Alaskan continental shelf. A significant component of this research included the development of a quantitative model that explains the causes of submarine slope instability and provides a means of assessing the mobilization potential of failed sediment that has universal application.

The incumbent has successfully led the development and application of a unique high-resolution sidescan-sonar capability that utilizes state-of-art digital data-logging and processing techniques, capable of producing images of the sea floor in near real-time. This capability puts the USGS Marine and Coastal Program in the forefront of sidescan-sonar imaging technology, a critical new tool for sea-floor mapping investigations. Surveys using these techniques have provided a new perspective on sedimentary processes, particularly the wide variety of spatial scales, which would have been impossible without these technological developments. The incumbent has had a major responsibility in applying these techniques to a variety of studies including: the evaluation of potential sites for dredge spoil disposal off San Francisco; an assessment of the effects of sewage on coral reefs in Puerto Rico; and an analysis of sediment transport paths related to coastal erosion in North Carolina, South Carolina, and Florida.

The incumbent has restructured and revitalized the USGS Marine Geology Program in Puerto Rico; a cooperative with the Commonwealth Department of Natural Resources. This program focuses on reconnaissance mapping of the insular shelf of Puerto Rico with special attention to the location of potential sand and gravel resources. In addition, the incumbent initiated a program (in collaboration with Duke University) to assess the impact of major storm events on the coastal resources and coastal environments of Puerto Rico. Results of this ongoing program have identified areas of extreme risk to coastal erosion and have identified sediment transport paths related to coastal change in two key areas; these findings are being used by the Commonwealth Government as a basis for policy decisions related to commercial development of the coastal zone. Research results form a basis for management and monitoring of the coastal zone environment which has a wide application to other regions.