

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

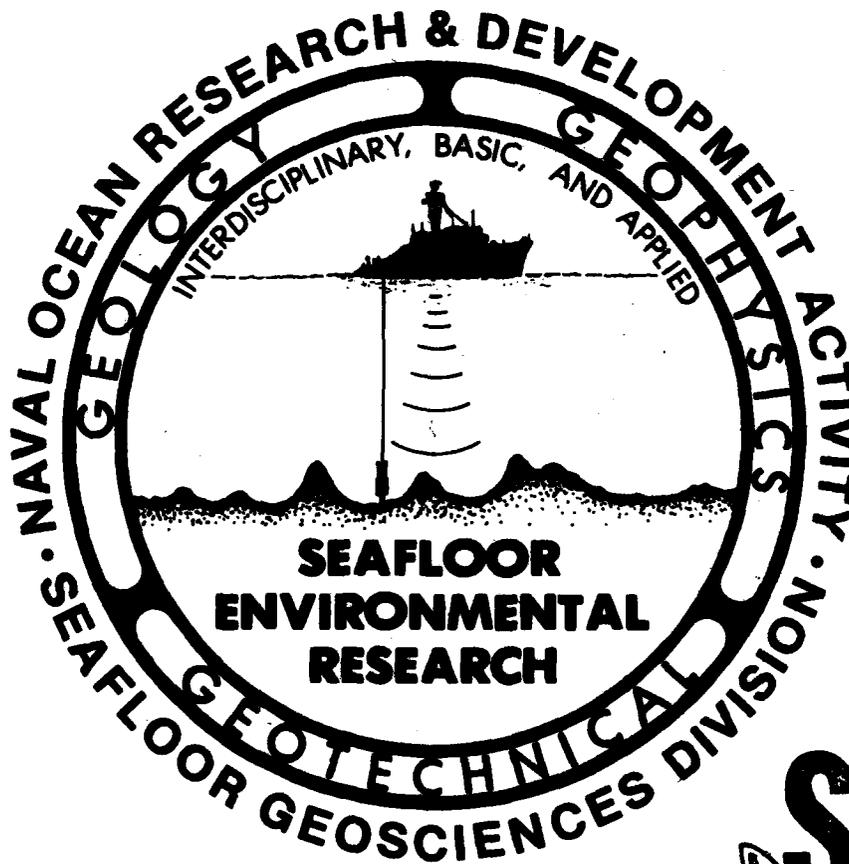
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Naval Ocean Research and
Development Activity
NSTL, Mississippi 39529



Seafloor Geosciences Division: Missions, Technical Specialties, Accomplishments, and Activities, Calendar Year 1984

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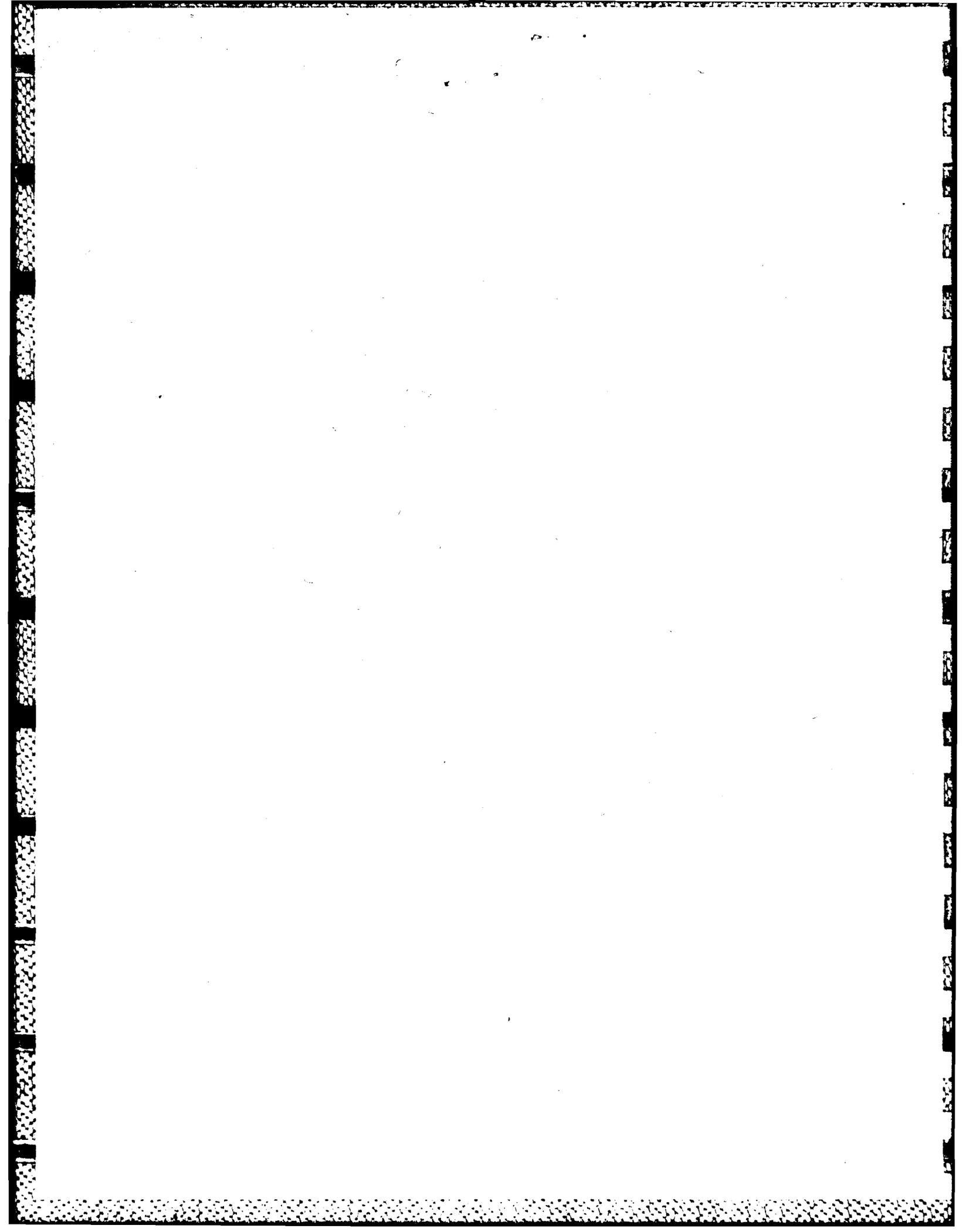
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Compiled by
F.L. Nastav and R.H. Bennett
Ocean Science Directorate
Seafloor Geosciences Division

July 1985

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MISSIONS

TECHNICAL SPECIALTIES

ACCOMPLISHMENTS & ACTIVITIES

CALENDAR YEAR 1984

SEAFLOOR GEOSCIENCES DIVISION

CODE 360

DR. RICHARD H. BENNETT, HEAD

MR. DONALD J. WALTER

TECHNICAL STAFF ASSISTANT

-BRANCHES-

MARINE GEOLOGY (CODE 361)

VACANT

MARINE GEOPHYSICS (CODE 362)

DR. JOSEPH F. GETTRUST, HEAD

MARINE GEOTECHNICAL (CODE 363)

DR. PHILIP J. VALENT, HEAD

ABSTRACT

The Seafloor Geosciences Division provides the Navy with expanded and advanced capabilities to conduct comprehensive geological, geophysical, and geotechnical investigations of the sea floor and sub-sea floor. Basic and applied research studies contribute to the fundamental knowledge of the oceanic crust and overlying sediments and the effective utilization of the sea floor. Interdisciplinary seafloor science and engineering investigations are ongoing in support of Navy problems, systems design, construction, and operations. Studies provide quantitative and qualitative description and understanding of the seafloor geological materials and environmental parameters directed toward advancing the state-of-the-art.

The major activities and capabilities of the Branches are briefly outlined at the beginning of each section, and in Table I. A statistics Table II summarizes the Division's accomplishments, activities, and productivity for calendar year 1984. Cooperative studies with other NORDA Divisions, industry, academia, and other government agencies are an integral part of the Division's activities.

This informal report is a summary of the Seafloor Geosciences Division's research accomplishments and professional activities for calendar year 1984. The purpose is to provide NORDA Management and NORDA Offices (Codes) with a timely document on the Division's productivity, accomplishments and capabilities. The report also is intended to provide a means of information exchange to system commands, oceanography commands and other Navy activities requiring seafloor environmental data. In addition, the report is designed to increase communication channels with colleagues interested in Division activities. Most publications and reports cited are available from the authors. Communications are invited and should be directed to Division staff members and authors.

SEAFLOOR GEOSCIENCES DIVISION



Accession For	
NTIS CRASI	<input checked="" type="checkbox"/>
ERIC EAD	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By Dr. R. H. Bennett	
Availability Status	
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HEAD
DR. R. H. BENNETT 360

TECHNICAL
STAFF ASSISTANT
MR. D. J. WALTER 360

MARINE
GEOLOGY
(VACANT) 361

MARINE
GEOPHYSICS
DR. J. GETTRUST 362

MARINE
GEOTECHNICAL
DR. P. VALENT 363



SEAFLOOR GEOSCIENCES DIVISION
Interdisciplinary Investigations
Geology — Geophysics — Geotechnique

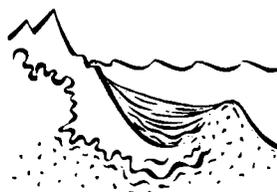
MAJOR THRUST — CHARACTERIZATION & QUANTITATIVE ANALYSIS OF:

- **GEOLOGICAL MATERIALS, STRUCTURE AND PROCESSES**
- **GEOACOUSTIC PROPERTIES/GEOACOUSTIC MODELING**
- **GEOTECHNICAL PROPERTIES OF SEAFLOOR DEPOSITS**
 - **TERRIGENOUS**
 - **CARBONATES**



INTERDISCIPLINARY STUDIES RATIONALE

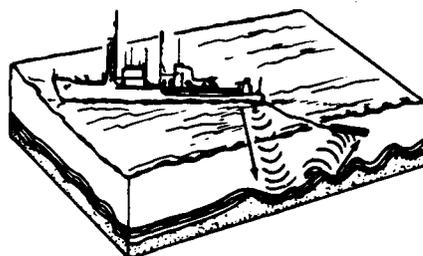
GEOLOGY



**DESCRIPTIVE
ANALYSIS/BACKGROUND**



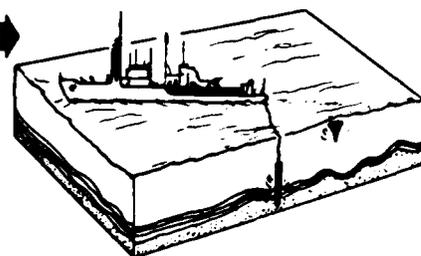
GEOPHYSICS



**QUANTIFICATION
BY REMOTE SENSING
OCEAN MEASUREMENTS**



GEOTECHNICAL



**QUANTIFICATION
BY IN SITU PROBES**

TABLE I

NORDA CODE 360 ASSETS/RESEARCH SUPPORT FACILITIES

- 0 COMPUTER FACILITY
- 0 SEDIMENTOLOGY LABORATORY
 - o X-RAY DIFFRACTION
 - o RADIOGRAPHY
- 0 SEDIMENT PHYSICS LABORATORY
- 0 GEOTECHNICAL (SOIL MECHANICS) LABORATORY
 - o TRIAXIAL APPARATUS
 - o CONSOLIDOMETERS
 - o SOIL CLASSIFICATION
 - o SHEAR STRENGTH (VANE SHEAR/DIRECT SHEAR)
 - o MASS PHYSICAL PROPERTIES TEST EQUIPMENT
 - o CORE EQUIPMENT
- 0 IN SITU GEOTECHNICAL PROBES
- 0 PENETROMETER TEST FACILITY
- 0 HIGH PRESSURE TEST FACILITY
- 0 GEOPHYSICAL SYSTEMS
 - o HONEYWELL-ELAC SEDIMENT CLASSIFIER
 - o 3.5 kHz PROFILER
 - o SIDE-SCAN SONAR SYSTEM (KLEIN)
 - o SINGLE CHANNEL SEISMIC PROFILER (AIRGUNS)
 - o OCEAN BOTTOM SEISMOGRAPHS (OBS)
 - o MAGNETOMETERS
- 0 CALIBRATION TEST FACILITY
 - o TEMPERATURE
 - o PRESSURE
- 0 ELECTRON MICROSCOPY LABORATORY
- 0 TRANSMISSION ELECTRON MICROSCOPE(TEM)
- 0 INSTRUMENTATION DEVELOPMENT AND FABRICATION FACILITY
(MECHANICAL/ELECTRONIC)
- 0 SEDIMENT CORE/SAMPLE REPOSITORY
- 0 LARGE GEOLOGICAL/GEOTECHNICAL DATA BASES
- 0 UNDERWATER PHOTOGRAPHY
 - o STATE-OF-THE-ART, U/W 70mm CAMERA SYSTEM
 - o OPERATIONAL RANGE OCEANIC DEPTHS 6,000 METERS
 - o PHOTOGRAPHIC CAPABILITIES IN MONO AND STEREO

SEAFLOOR GEOSCIENCES DIVISION
CODE 360

MISSION/BASIC RESPONSIBILITIES

The Seafloor Geosciences Division is responsible for managing and conducting geological, geophysical, and geotechnical investigations which advance the state-of-the-art. It provides the Navy with the understanding, description, modeling and quantitative prediction of marine geological environments in terms which relate to Navy systems design, construction and operations.

Telephone Number for Seafloor Geosciences Division:
(601) 688-4657, AUTOVON 485, FTS 494

Dr. Richard H. Bennett, Head, Supervisory Oceanographer (Interdisciplinary)

Technical Specialties:

- o Marine Geotechnique
- o Clay Microstructure
- o Seafloor Stability
- o In Situ Geotechnical Probe Development
- o Shallow Water and Deep-Ocean Piezometer Systems

Mr. Donald J. Walter, Technical Staff Assistant to Division Head

Technical Specialties:

- o Resource Allocation
- o Budgetary Planning and Projections
- o Project and Program Planning and Analysis
- o Logistical Planning
- o Technical Administration
- o Assist in Division Policy Development
- o Manpower Utilization

Ms. Kathy McIntosh: Division Secretary

Technical Specialties:

- o Division Correspondence
- o Word Processing
- o Maintains Record Control
- o Travel arrangements
- o Arranges meetings and conferences
- o Division Timekeeper
- o Provides guidance to Division clerical personnel

Ms. Sandra Eades, Administrative Assistant

Technical Specialties:

- o Financial Records
- o Budgets
- o Personnel Records
- o Purchasing (Division Level)
- o AIMAT Coordinator
- o Division Logistics

Ms. Cynthia Sellinger, Geologist

Technical Specialties:

- o Mapping and Charting
- o Marine Geology
- o Sedimentology, Analytical Techniques

Ms. Lee Nastav, Physical Science Technician

Technical Specialties:

- o Processing and reduction of raw data
- o Library research for marine geological, geophysical and geotechnical applications
- o Design, display, compilation of maps, graphs, illustrations for storage and publication of data
- o Technical editing, proofing, fabricating mock-ups for manuscript publications
- o Record maintenance

MARINE GEOLOGY BRANCH
CODE 361

MISSION/BASIC RESPONSIBILITIES

Marine Geology investigations of coastal and deep-ocean environments are directed toward the understanding of the sedimentology, structural geology, acoustic stratigraphy, processes and environmental parameters as they relate to Navy activities. Advanced field and laboratory techniques are utilized to improve the quality and resolution of geological parameters which advance the state-of-the-art. Consultation and service activities are in direct support of Navy requirements. Regional and site specific studies are designed to provide improved description of the geological environments and to advance predictive modeling capabilities.

Telephone Number for Marine Geology Branch:
(601) 688-4906, AUTOVON 485, FTS 494

Branch Head (Supervisory Geologist), Science and Technical Manager

Vacant

Dr. Frederick A. Bowles, Oceanographer

Technical Specialties:

- o Sedimentation
- o Stratigraphy
- o Mineralogy

These disciplines are employed to extend our knowledge of the seafloor environment, specifically relating to such things as bottom current patterns, climatic influences on sedimentation, delineation of depositional history, sediment dispersal, etc.



INVESTIGATIONS IN GEOSCIENCES

GEOLOGY

STUDIES

- **GEOLOGIC HISTORY/EVOLUTION OF OCEAN BASINS**
- **MAPPING — GEOLOGY/BATHYMETRY/MORPHOLOGY**

SIGNIFICANCE

- **DEVELOP PREDICTIVE CAPABILITY**
- **GEOACOUSTIC MODELS/BOTTOM ROUGHNESS**

Dr. Peter Fleischer, Geologist

Technical Specialties:

- o Marine Geology
- o Sedimentation
- o Sedimentary processes and geology of continental margins
- o Geologic processes of coastal and estuarine environments
- o Deep sea bedforms and sediment transport
- o Seafloor characterization techniques
- o Clay mineralogy

Mr. Julius Egloff, Geologist

Technical Specialties:

- o Seafloor Geology
- o Geomorphology
- o Tectonics of continental margins and mid-ocean rises
- o Survey technologies
- o Interpretation of seismic reflection, side-scan sonar, and bathymetric data
- o Geographically specializing in the North Atlantic Ocean, Greenland-Norwegian Seas, Labrador Sea, Gulf of Mexico, Caribbean and Mediterranean and North Seas, etc.

Ms. Anna M. Einwich, Oceanographer

Technical Specialties:

- o Marine Geology
- o Geomorphology
- o Ocean basin history (and related studies) through interpretation of seismic and magnetic data, bottom photographs and cores

Mr. William B. Sawyer, Geologist

Technical Specialties:

- o Marine Geology
- o Marine Geotechnique
- o Sedimentology
- o Seafloor classification using side-scan sonar and 3.5 kHz subbottom profiling
- o Classical sedimentological and geotechnical laboratory techniques of marine sediments
- o Marine geological field techniques and methods including bottom sampling and photography, seismic reflection profiling, side-scan sonar and field sample processing

Mr. Walter H. Jahn, Photographic Technologist

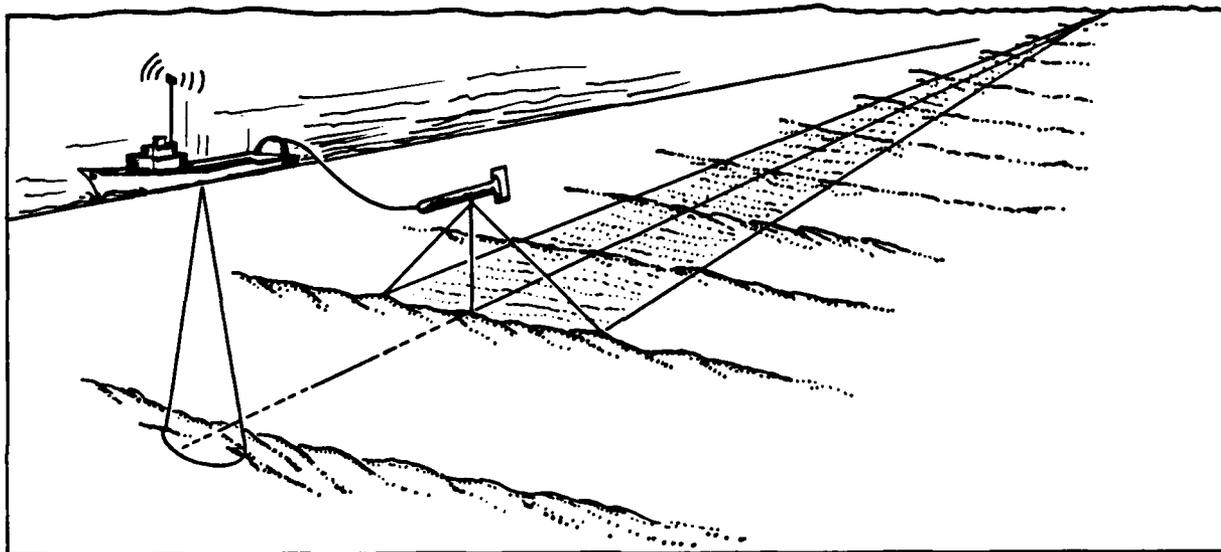
Technical Specialties:

- o Deep Ocean Photography
- o Marine Geology
- o Coring Program
- o Constructing, fabricating, designing various oceanographic instruments and packages to be used at sea

Dr. Raymond P. Freeman-Lynde, NRC-NORDA Cooperative Associate
Present affiliation University of Georgia at Athens

Technical Specialties:

- o Marine Geology
- o Sedimentology
- o Carbonate Sedimentology
- o Continental Margins: Marine geology of continental margins with emphasis on steep carbonate escarpments at passive continental margins



**SHALLOW WATER GEOLOGIC ACOUSTIC PROFILING
AND SCANNING SYSTEM**



INVESTIGATIONS IN GEOSCIENCES GEOPHYSICS

STUDIES

SEISMOLOGY

- FINE-SCALE GEOACOUSTIC PROPERTIES
- BOUNDARY LAYER ACOUSTICS

GEOMAGNETICS

- PLATE TECTONICS
- GEOMAGNETIC FIELDS

SIGNIFICANCE

- VARIABILITY DEFINED/VELOCITY ANALYSIS
- ENERGY PARTITIONING
- ATTENUATION
- SCATTERING
- SUBBOTTOM ROUGHNESS
- HISTORY OF OCEAN BASINS
- SEAFLOOR GEOCHRONOLOGY
- CRUSTAL PROCESSES

MARINE GEOPHYSICS BRANCH
CODE 362

MISSION/BASIC RESPONSIBILITIES

Emphasis is on the development of research programs in seismology (geoacoustics), geomagnetism/plate tectonics, and geoelectric fields and methods. Field investigations and theoretical modeling are integral aspects of the geophysical programs. These include quantitative and statistical analysis of a broad spectrum of geophysical data in support of Navy requirements. Cooperative interdisciplinary investigations are directed toward advancing the state-of-the-art in seismology, geomagnetism, and geoelectric techniques.

Telephone Number for Geophysics Branch:
(601) 688-4906, AUTOVON 485, FTS 494

Dr. Joseph F. Gettrust, Branch Head (Supervisory Research Geophysicist), Science and Technical Manager

Technical Specialties:

- o Solid Earth Geophysics, specializing in seismology
- o Marine Geology, especially structure of the crust and upper mantle and its seismological expression
- o Application of mathematical physics and computers to geophysical and geological problems
- o Digital computers and geophysical instrumentation and their experimental applications
- o Management of large-scale geophysical field and laboratory programs

Ms. Linda H. Conner, Secretary

Technical Specialties:

- o Functions as Secretary for Geophysics Branch
- o Types correspondence, reports, etc., for three Branches
- o Coordinates telephone calls and visitors for Branch personnel
- o Maintains and controls office files and records
- o Word processing

Dr. G. Lafayette Maynard, Senior Research Geophysicist
(On extended training: Allied Geophysical Lab, University of Houston, Houston, TX.)

Technical Specialties:

- o Seismology and seismic instrumentation; especially exploration seismology at sea
- o Observatory (earthquake) seismology
- o General marine geophysics and geological oceanography

Dr. David Handschumacher, Senior Research Geophysicist

Technical Specialties:

- o Plate Tectonics (seafloor spreading)
- o Geomagnetism (plate tectonics, geomagnetic reversals, oceanic crust, seamounts)
- o Aeromagnetic Survey Operations

Ms. Muriel S. Grim, Geophysicist

Technical Specialties:

- o Geology and geophysical properties of the U.S. Atlantic Continental Margin
- o Exploration seismology-processing and analysis of seismic data

Mr. William H. Everard, Electronics Engineer

Technical Specialties:

- o Design and development of electronic circuits and systems
- o General meteorological, oceanographic, and geophysical instrumentation
- o Data acquisition systems

Mr. Eugene Morgenthaler, Geologist

Technical Specialties:

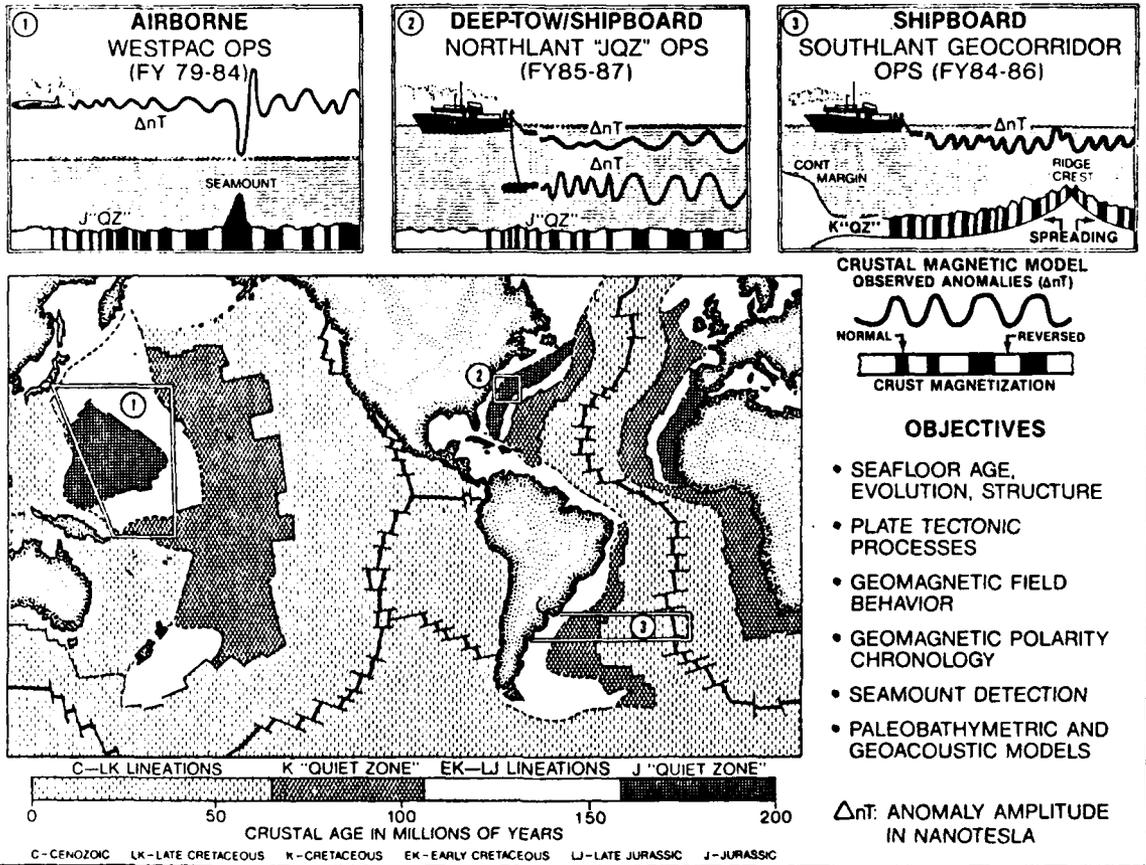
- o Scientific support of Geomagnetism and Plate Tectonics Program
- o Field Investigations: Collection, processing, and compilation of geomagnetic data
- o Study of crustal structure, age and evolution
- o Analysis and interpretation of airborne/marine magnetic data

Mr. Steve Madosik III, Physical Science Technician

Technical Specialties:

- o Computer programming
- o Data base management
- o Computer data processing
- o Management of research computer facility

GLOBAL FIELD INVESTIGATIONS: Geomagnetism/Plate Tectonics





INVESTIGATIONS IN GEOSCIENCES

GEOTECHNICAL

STUDIES

- **GEOTECHNICAL PROPERTIES — SEAFLOOR DEPOSITS**
- **IN SITU PROBE DEVELOPMENT**
- **LAB MEASUREMENTS**

SIGNIFICANCE

- **QUANTITATIVE ANALYSIS/VARIABILITY**
- **ENGINEERING APPLICATION**
- **“GROUND TRUTH” REMOTE SENSING SYSTEMS**
- **GEOACOUSTIC MODELS**

MARINE GEOTECHNICAL BRANCH
CODE 363

MISSION/BASIC RESPONSIBILITIES

The Marine Geotechnical Branch conducts basic and applied research and technology programs to advance the state-of-the-art in Marine Geotechnique of relevance to the design and performance of Navy systems and instrumentation. Investigators identify and conduct research of major scientific and geotechnical engineering merit. As a primary marine geotechnical activity within the Navy laboratory system, the Branch provides direct support of environmental requirements of the sea floor.

Telephone Number for Marine Geotechnical Branch:
(601) 688-4906, AUTOVON 485, FTS 494

Dr. Philip J. Valent, Head, (Supervisory Oceanographer), science and technical manager, Registered Civil Engineer, California and Texas

Technical Specialties:

- o Determination of geotechnical parameters in the nearshore and deep ocean, including survey planning, and selection and design of survey equipment
- o Measurement of geotechnical parameters in the laboratory
- o Prediction of the engineering behavior of calcareous sediments
- o Development and evaluation of penetrometer/probe sensor systems for in situ measurement of geotechnical parameters

Ms. Dianne Morris, Secretary

Technical Specialties:

- o Functions as Secretary for Marine Geology Branch and Marine Geotechnical Branch
- o Types correspondence, reports, etc., for two Branches
- o Coordinates telephone calls and visitors for Branch personnel
- o Maintains and controls office files and records
- o Word processing

Dr. Huon Li, Oceanographer

Participating NORDA senior scientist in several ongoing research programs

Technical Specialties:

- o Fluid Mechanics
- o Magnetohydrodynamics
- o Sea Ice Dynamics
- o Sediment Transport
- o Thermodynamics

Mr. James E. Matthews, Geophysicist

Technical Specialties:

- o Geophysics: seismic reflection interpretation, long wavelength magnetic modeling, development of regional geological/geophysical synthesis
- o Geotechnical: dynamic elastic moduli measurement technique, shear wave measurements in soft solids

Mr. Douglas N. Lambert, Oceanographer

Technical Specialties:

- o Marine geotechnique
- o Geological and geotechnical laboratory testing and equipment operation
- o Deep submergence research including in situ instrumentation design
- o In situ geotechnical probe design and development
- o Laboratory data acquisition systems and instrument automation
- o High-pressure transducer testing and calibration
- o Seafloor geotechnical analysis and slope stability

Ms. Dawn Lavoie, Geologist

Technical Specialties:

- o Geoacoustic modeling; development of regional geological and geophysical syntheses
- o Sedimentation (especially coastal processes)
- o Carbonate petrology

Mr. Frank Carnaggio, Senior Electronics Technician

Technical Specialties:

- o Design and development of transducers and systems used to measure, record, and analyze physical properties such as temperature, pressure, shear and compressional wave velocities for use in the laboratory as well as for use in remote locations and hostile environments
- o Design and development of facilities such as precision thermal baths and pressure chambers used in testing and calibrating physical parameter measurement transducers and systems

Mr. John T. Burns, Electronics Technician

Technical Specialties:

- o Design and development of piezometer probes used in geotechnical investigations
- o Operation of NORDA's high pressure test facility
- o Instrumentation design for in situ geotechnical measurements

Mr. David C. Young, Mechanical Engineering Technician

Technical Specialties:

- o Designs/assists in the design of mechanical subsystems and systems for geotechnical research
- o Design modifications to existing equipment to suit specialized research needs
- o Researches feasibility and availability of existing equipment and materials which could be used in prototype equipment
- o Machinist-performs a wide variety of machine work for fabrication of experimental prototype equipment

Ms. Gail Romero, Physical Science Technician

Technical Specialties:

- o Classical geotechnical laboratory techniques for submarine sediments
- o Sediment sample preparation for transmission electron microscopy
- o Marine geological and geotechnical field techniques and methods
- o Operation of Scanning Electron Microscope (SEM)
- o Operation of Transmission Electron Microscope (TEM)
- o Editing bathymetric charts
- o Literature searches and mapping historical geological survey sites

PROBES FOR MEASUREMENT

of

SEAFLOOR PROPERTIES

Reliable measurement of seafloor sediment properties is required for geoacoustic modeling, mine burial prediction, electrical field characterization, anchor selection, sediment stability assessment, trafficability prediction, and cable stabilization/protection design. Standard sampling and testing methods, particularly when applied in sands, often do not provide sufficiently reliable sediment properties measurements for safe, yet economical, sediment performance prediction. These shortcomings in capability are being addressed by NORDA scientists and engineers. Present NORDA in situ measurement capabilities include sediment pore water pressure, shear strength, electrical conductivity, and compressional and shear wave velocities.

The most recent development is a diver operated conductivity probe that measures directly the sediment conductivity (or resistivity), temperature, and probe penetration below the sea floor. Sediment porosity and bulk density are calculated with excellent reliability from these measured values. The system is self-contained; it includes a power source, signal generator and conditioner, temperature monitor, A/D converter, and digital data storage. The conductivity probe was designed and fabricated within NORDA in support of the basic research project titled "Effects of Shallow-Water Geologic Processes on High Frequency Scattering.

A piezometer probe has been developed and used to measure excess pore pressures generated by probe insertion at a water depth of 5,800 m and to an accuracy of 0.05 psi. The excess pore pressures generated by insertion of the probe can be interpreted to classify the sediment type and to estimate the sediment permeability, porosity, and shear strength. The residual excess pore pressure remaining after dissipation of the insertion pressure can be used to help assess slope stability and the rate of pore water flow due to thermal gradients. The deepwater piezometer system has been developed for the In Situ Heat Transfer Experiment, part of the Seabed Disposal Program managed by Sandia National Laboratories for the Department of Energy.

Diver-operated compressional wave velocity probes have been developed, and shear wave velocity probes are being developed. Data are transmitted over an electrical umbilical to a surface support platform. Compressional and shear wave velocity data, when combined with bulk density data obtained from the conductivity probe, permit complete description of the sediment elastic properties for use in acoustic bottom interaction models. The compressional and shear wave velocity probe development was initiated in support of a basic research effort into acoustic bottom interaction supported by NORDA.

PROBE DEVELOPMENT

Principal Investigators responsible for the development of specific in situ probes are:

James Matthews: Shear and Compressional Waves
Douglas Lambert: Electrical Conductivity/Resistivity
Richard Bennett: Pore Water Pressure (Piezometer)

Technicians responsible for electronics and engineering:

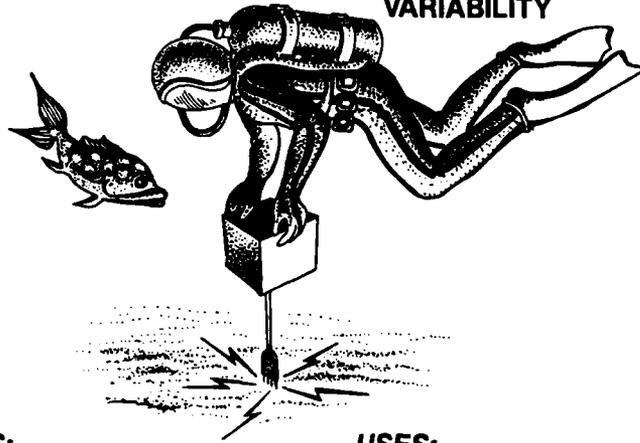
Frank Carnaggio
John Burns
David Young



DIVER OPERATED CONDUCTIVITY PROBE

MEASURES DIRECTLY: SEAFLOOR CONDUCTIVITY OR RESISTIVITY
TEMPERATURE
DEPTH OF PENETRATION

MEASURES INDIRECTLY: SEDIMENT: POROSITY
BULK DENSITY
PROPERTY-
VARIABILITY



FEATURES:

SELF CONTAINED SYSTEM:

POWER SOURCE
SIGNAL GENERATOR
SIGNAL CONDITIONER
TEMPERATURE MONITOR
A/D CONVERTOR
DIGITAL DATA STORAGE

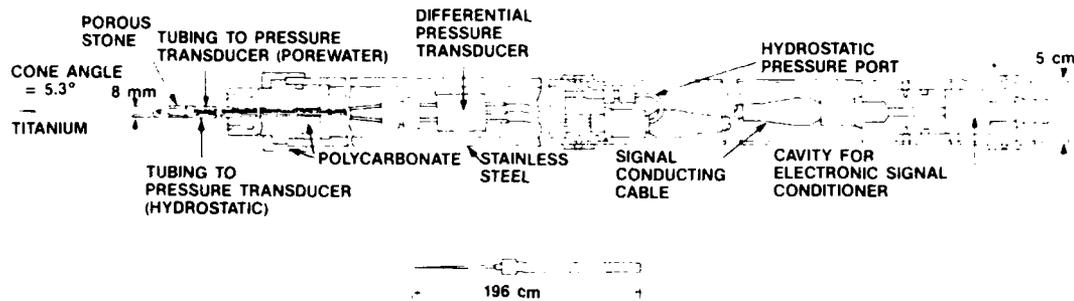
USES:

RAPID SITE SPECIFIC SURVEYS
INPUT TO MODELS:

ACOUSTIC
GEOACOUSTIC
MINE BURIAL
ASW ARRAYS
OTHER ELECTRICAL FIELDS
GEOTECHNICAL



DEEP OCEAN PIEZOMETER PROBE



MEASURES DIRECTLY: EXCESS PORE WATER PRESSURES IN THE SEDIMENT

MEASURES INDIRECTLY: SEDIMENT: PERMEABILITY
TYPE
UNDRAINED SHEAR STRENGTH
PORE PRESSURE GRADIENTS

FEATURES: OPERABLE TO 6,000 m WATER DEPTH

ACCURACY OF ± 0.05 psi (0.3 kPa)

A/D CONVERTER

USES: SLOPE STABILITY ASSESSMENT FOR CABLE AND PIPELINE ROUTING

PORE WATER FLOW MEASUREMENT FOR CONTAMINANT DISPERSAL EVALUATION

RAPID SEDIMENT CLASSIFICATION FOR MCM, AMPHIBIOUS FORCES

EFFECTIVE STRESS ANALYSIS: STATE OF CONSOLIDATION



PRESSURE
VESSEL

CAL

PRESSURE
GENERATOR

CONTROL
ELECTRONICS

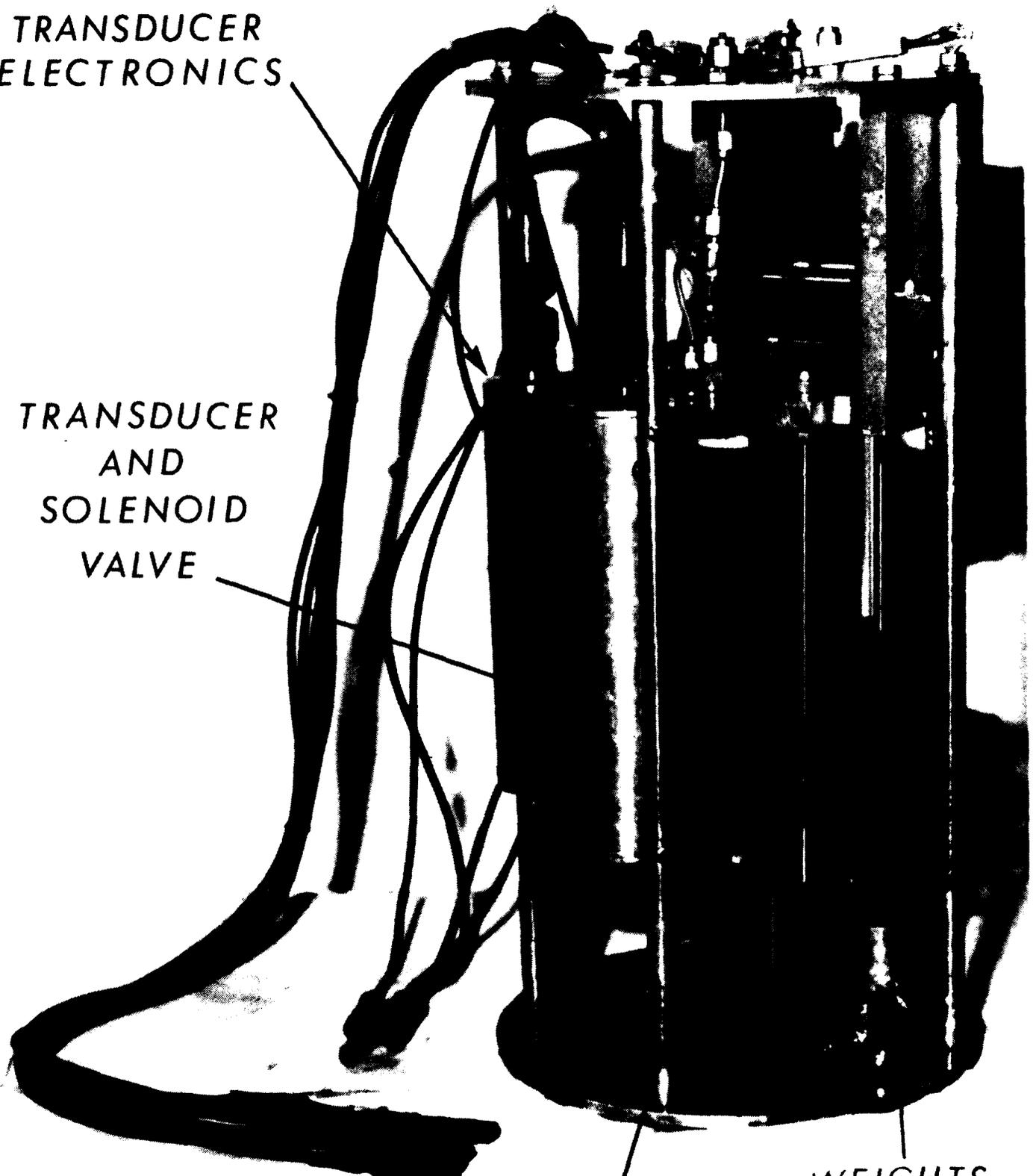
NORDA HIGH PRESSURE
TEST CHAMBER

TRANSDUCER
ELECTRONICS

TRANSDUCER
AND
SOLENOID
VALVE

PRESSURE
COMPENSATION BELLOWS

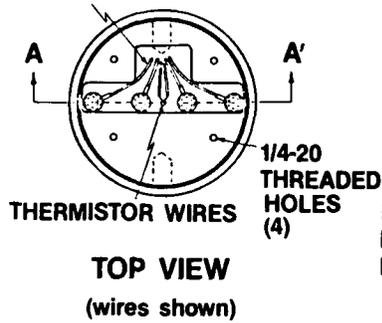
WEIGHTS
HIGH PRESSURE
CALIBRATOR



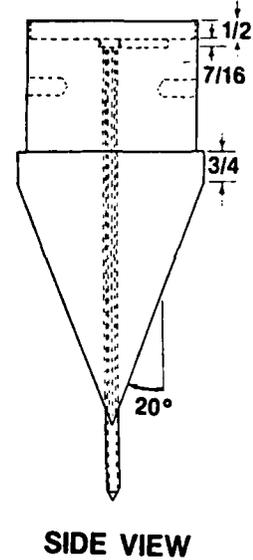
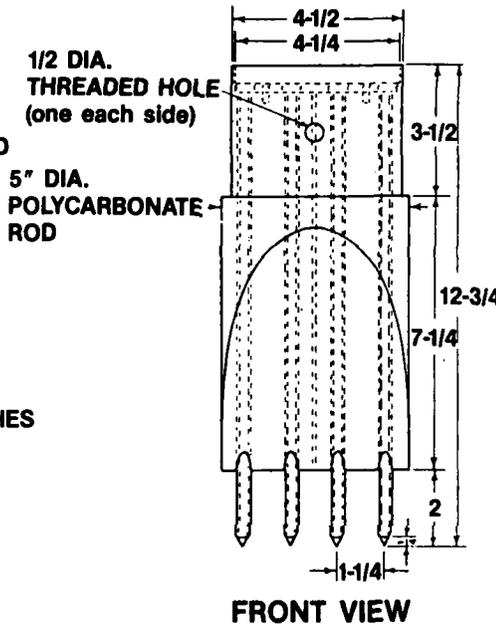


RESISTIVITY PROBE

ELECTRODE WIRES TO
UNDERWATER CONNECTORS



ALL DIMENSIONS IN INCHES
1 in = 2.54 cm



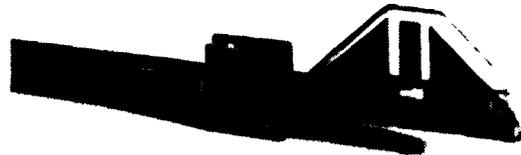
TIP FOR ATTACHMENT TO VIBRA-CORER FOR SUB-BOTTOM PENETRATION
TO ~20 FT (~6M)



COMPRESSIONAL AND SHEAR WAVE PROBES



ACTIVE END OF
COMPRESSIONAL WAVE PROBE



ACTIVE END OF
SHEAR WAVE PROBE

MEASURES DIRECTLY: COMPRESSIONAL WAVE VELOCITY
COMPRESSIONAL WAVE ATTENUATION
SHEAR WAVE VELOCITY

MEASURES INDIRECTLY: SEDIMENT: BULK MODULUS
SHEAR MODULUS
YOUNG'S MODULUS
POISSON'S RATIO

FEATURES: 1. FREQUENCY: COMPRESSIONAL ~ 70 kHz, SHEAR ~ 2 kHz
2. GOOD COUPLING IN SOFT SEDIMENTS
3. CAN BE EMBEDDED IN SANDS WITH MINIMAL
DISTURBANCE

USES: GEOACOUSTIC MODEL INPUTS
EMPIRICAL DATA ON V_p/V_s RATIOS

TABLE II

STATISTICS OF YEARLY ACCOMPLISHMENTS AND ACTIVITIES

Papers/Books Published.....	11*
Papers/Books in Press.....	15*
Papers Submitted.....	8
Abstracts.....	8
Presentations/Seminars.....	14
Committees/Advisory Activities/Editorial Boards.....	20

*Reflects some papers not listed herein

PAPERS/BOOKS PUBLISHED IN 1984

- Almagor, Gideon, Richard H. Bennett, Douglas N. Lambert, Evan B. Forde, and Les E. Shephard. Analysis of Slope Stability, Wilmington to Lindenkohl Canyons, US Mid-Atlantic Margin. p.77-86 in: ed. Bruce Denness, Seabed Mechanics. 281 p. Proceedings of IUTAM/IUGG Symposium, 5-9 September, 1983. University of Newcastle upon Tyne, UK.
- Bennett, Richard H., Frances L. Nastav, and William R. Bryant. Strength Measurements. Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of the Deep Sea Drilling Project Volumes 1-44: An Overview. World Data Center A for Marine Geology and Geophysics Report MGG-1. World Data Center A/National Academy of Sciences, Wash., DC. p. 129-146.
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- Bennett, R. H., L. Lehman, M. H. Hulbert, G. Harvey, S. Bush, E. B. Forde, P. A. Crews, W. B. Sawyer. Interrelationships of Organic Carbon and Submarine Sediment Geotechnical Properties. Marine Geotechnology. v. 6, No. 1.
- Bennett, Richard H., and Matthew H. Hulbert, Clay Microstructure-An Historical Perspective of Clay Fabric and Physico-Chemistry of Fine-Grained Mineral Sediments. IHRDC.
- Bennett, R. H., Huon Li, P. J. Valent, J. Lipkin, and M. I. Esrig. In Situ Undrained Shear Strengths and Permeabilities Derived from Piezometer Measurements. ASTM Symposium on Laboratory and In Situ Testing of Marine Soils. ASTM Special Technical Pub.
- Bennett, R. H., J. T. Burns, F. L. Nastav, J. Lipkin, and C. M. Percival. Deep-Ocean Piezometer Probe Technology for Geotechnical Investigations. Jour. Oceanic Engineering.
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- McTigue, D. F., J. Lipkin, and R. H. Bennett. Isothermal Mechanical Response of Sediment in the ISHTE Simulation Experiment. SAND 83-1847, Sandia National Laboratories.
- Merrill, G. F., and R. H. Bennett. Slope Map of a Geotechnical Corridor on the Atlantic Continental Margin Southeast of Cape May, (6 plates, scale 1:40,000). NOAA/NORDA.
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PAPERS SUBMITTED IN 1984

Bennett, R. H., Philip J. Valent, Huon Li, John T. Burns, Douglas N. Lambert, and F. Lee Nastav. NORDA's Activities in the In Situ Heat Transfer Experiment (ISHTE), FY 83 Annual Report. Sandia National Laboratories.

Lipkin, J., R. H. Bennett, and D. F. McTigue. Response of Marine Sediment to Rapid Changes in Hydrostatic Pressure Part II: Comparison of Data and Model Predictions. Geotechnique.

McTigue, D. F., J. Lipkin, and R. H. Bennett. Response of Marine Sediment to rapid Changes in Hydrostatic Pressure Part I: Poroelastic Model Analysis. Geotechnique.

Fleischer, Peter, and Jean-Pierre Feuillet. Deposition of Clay Minerals on the continental Slope by the Circulation Complex off Southeastern United States. J. Sed. Pet.

Freeman-Lynde, R. P., and W. B. F. Ryan. Subsidence History of the Bahama Escarpment and the Nature of the Crust Underlying the Bahama Platform. Tectonics.

Young, D. K., W. H. Jahn, M. D. Richardson and A. W. Lohanick. Photographs of Deep-Sea Lebensspuren: A Comparison of Sedimentary Provinces in the Venezuelan Basin. Special issue of marine Geology.

Lambert, D. N., P. J. Valent, M. D. Richardson, and G. F. Merrill. Spatial Variability in Selected Geotechnical Properties from Three Sedimentary Provinces in the Venezuela Basin. Marine Geology.

Matthews, J. E., and T. L. Holcombe. Venezuelan Basin of the Caribbean Sea-Stratigraphy and Sediment Distribution. Marine Geology.

ABSTRACTS IN 1984

- Bennett, R. H., W. R. Bryant, P. J. Burkett, and L. E. Shephard. Microstructure of Red Clays From the Northwest Pacific Deep Sea Basin. Submitted to AIPEA.
- Bryant, W. R., R. H. Bennett, L. E. Shephard, and P. J. Burkett. Identification of Aeolian Argillates in the Red Clays of the Northwest Pacific. Submitted to AIPEA.
- Hulbert, Matthew H., and R. H. Bennett. Chemical Irreversibility in Clay Microstructure Development. Submitted to the 1985 International Clay Conference.
- Bowles, F. A., R. H. Bennett, and D. K. Hubbard. Geomorphology and Sediments of the Virgin Island Trough and Slope off St. Croix Island. 10th Caribbean Geological Conference.
- Hubbard, D. K., I. P. Gill, H. H. Roberts, and F. A. Bowles. Variations in Shelf-Edge and Peri-Platform Depositional Styles Around St. Croix, U. S. V. I. SEPM.
- Fleischer, Peter. Mine Burial: Field Tests to Assess its Likelihood in United States Waters and to Evaluate Burial Prediction. Submitted for 25th Mine Development Conference (13 May 85), NSWC, White Oak, MD.
- Fulker, K. D., and R. P. Freeman-Lynde. Origin of Cements in Bahama Escarpment Limestones. SEPM Annual Mid-Year Meeting, San Jose, CA., August 10-13.
- Montera-Gutierrez, C., G. J. Fryer, and J. F. Gettrust, Deep Crustal Structure and Upper Mantle Anisotropy in the ROSE Area. EOS, V. 65, p. 1013.

PROJECTS/PAPERS IN PREPARATION IN 1984

Nelsen, T. A., and R. H. Bennett

Soft Sediment Deformation Structures on the slope Northeast of Wilmington Canyon: A Petrographic Study of Their Origin

Bowles, F. A.

Late Oligocene sediments on the south flank of the Iceland-Faeroe Ridge: Correlation with seismic reflection profiles

Geology of the Virgin Trough

Investigation of Miocene sediment core from the Fredericksted Plateau Escarpment (V. I. Trough)

Egloff, J.

Seafloor acoustic reflectivity provinces in the deep basins. Contribution to the Geophysical Atlas of the Northern North Atlantic and Labrador Sea, to be published by the German Hydrographic Institute (DHI)

Einwich, A. M.

An area of anomalous sediments in the Angola Basin, South Atlantic

Fleischer, P.

Site evaluation/selection for second High Frequency Acoustic Scattering Experiment (rippled or rough bottom)

Planning for site characterization for 1985 6.2 High Frequency Acoustic Experiment, Jacksonville, FL

Freeman-Lynde, R. P.

Erosional modification of the Florida Escarpment limestones

Jahn, W. H.

Environmental support for High Frequency Acoustic Experiments conducted at the Quinault Range off Washington coast in 1983

Lavoie, D.

Variability of sediment layering in the seafloor environment

Li, H.

Impact of probe insertion on the measured geotechnical properties of sediments

Madosik, S.

Continued improvement in Code 360's ADP efforts
Configuration of Seismic Analysis Lab
Data transfer and storage

Morgenthaler, E.

The Aeromagnetic Detection of Three Large Uncharted Seamounts in the

Northwest Pacific (with Handschumacher and Sager), to be submitted to Survey Review

Processing and compiling all South Atlantic Geo-Corridor ('83, '84, and '85) data bases including navigation, magnetics, bathymetry, and basement, for crustal and ridge crest studies

Sawyer, W. B., D. N. Lambert, and R. H. Bennett.

A New Single Piston Helium Pycnometer for the Rapid Determination of Average Grain Density of Powdered Materials

Valent, P. J.

Section 1.3: Seafloor Site Surveys. Handbook of Ocean Engineering, ed. A. Berman, to be published by Academic Press 1985

Riggins, M., P. J. Valent, C. Hickox, J. T. Burns, and H. Li. Pore Pressure Response to Probe Insertion and Thermal Gradient. NORDA TN

Young, D. C.

Design/design assistance of various instrument packages and hardware for NORDA Code 333's "TUPS" (Towed Underwater Pumping System) Fish and related equipment for Code 333's Chemical Fronts Project

Fabrication of hardware for Code 333's Chemical Fronts Project

Design/design assistance of equipment for Geotechnical Properties Project

Fabrication of shear and compressional wave transducers for field and lab analyses of sediment, rock, and ice samples

Young, D. C., and J. E. Matthews. Mechanical Details of a Portable Velocimeter Frame. NORDA TN

PRESENTATIONS/SEMINARS IN 1984

Bennett, R. H.

The Naval ocean Research & Development Activity's Seafloor Geosciences Division Technical Programs and Selected Research Studies. Presented to U. S. Department of the Interior's Minerals Management Service, Metairie, LA.

In Situ Shear Strengths and Permeabilities Derived from Piezometer Measurements in Marine Soils. Presented to the Naval Civil Engineering Lab (NCEL), Port Hueneme, CA. NORDA/NCEL Seminar Series.

In Situ Undrained Shear Strengths and Permeabilities Derived from Piezometer Measurements. Presented to the ASTM Symposium on Laboratory and In Situ Determination of the Strength of Marine Soils, San Diego, CA.

Technical and Scientific Capabilities in the Seafloor Geosciences Division. Informal presentation to Mine Warfare personnel, Washington, DC.

Seafloor Geosciences Division Ocean Measurement Capabilities. Informal presentation to NOAA'S Ocean Assessment Division, Washington, DC.

Geotechnical Properties Derived from Piezometer Measurements. NORDA Seafloor Geosciences Division informal seminar, NSTL.

Seafloor Geosciences Division Research Programs and Activities. NORDA presentation to the Naval Research Advisory Committee (NRAC), NSTL.

Bowles, F. S.

Orinoco/Amazon River Sediment Input to the Eastern Caribbean Basin. Oral presentation to the American Geophysical Union Ocean Sciences Meeting, New Orleans, LA.

Egloff, J.

Sediment dynamics of the southeast Greenland Continental Margin. Presentation to the Minerals Management Service of the U. S. Department of the Interior, Metairie, LA.

Fleischer, P.

NORDA Geological Program Focus on the Coastal and Estuarine Environments. Presented in NORDA Seminar Series, NSTL.

Gettrust, J. F.

Variability in Oceanic Crustal Structure. Texas A&M.

Lavoie, D.

Washington Continental Margin. NORDA Code 360 Brown Bag Seminar, NSTL.

Valent, P. J.

FY84 Contributions to the Subseabed Disposal Program. Presented to the Annual Subseabed Disposal Program Workshop, Denver, CO.

Albertson, N. D., and P. J. Valent
Nearshore Geotechnical Surveying Technology Development Plan. Presented at
NAVFAC Hdq., Alexandria, VA.

COMMITTEES/ADVISORY ACTIVITIES/EDITORIAL BOARDS IN 1984

Bennett, R. H.

NRC advisor and sponsor for post-doctoral research associateships in marine geotechnique, geology, and geophysics (NORDA)

Attended NORDA's senior management meetings, Diamondhead, MS.

Member, Joint Oceanographic Institutions-U. S. Science Advisory committee (JOI-USSAC)

Member, NORDA's Technical Management Council (TMC)

Member, NORDA committee on best paper awards

Adjunct Professor, Texas A&M University, Dept. of Oceanography

Adjunct Associate Professor, Ocean Engineering Division, University of Miami

Member, Editorial Board, Marine Geotechnology, an international journal of seafloor science and engineering

Member, Editorial Board, Applied Ocean Research, CML Publications

Member, ISHTE Project Planning Group

Member, Gulf Coast Chapter Sigma Xi, The Scientific Research Society

Chairman, NORDA's Performance Rating and Incentive Awards Board

Gettrust, J. F.

Member, NSF panel reviewing the future of marine multichannel seismology

Reviewer: NSF proposals, BSSA manuscripts, JGR manuscripts

Grim, M.

Member, NORDA ADP Committee

Nastav, F. L.

Invited member, Evaluation Panel for NORDA Code 120

Valent, P. J.

Chairman, Mooring Line Longevity Subcommittee, ASCE Ocean Engineering Committee. Presently engaged in gathering performance data and assembling design guidelines

Member, Subcommittee D18.13, Marine Geotechnology, American Society for

Testing and Materials (ASTM)

Member, Subcommittee D18.17, Rock for Erosion Control, ASTM

Board of Examiners, Indian Institute of Technology, Delhi, India

Reviewed PhD. Thesis of A. M. Deshmukh: Coral Reef Rock - A Geotechnical Study

Co-Chairman, Session on In Situ Soil Testing, Offshore Technology Conference, Houston, TX

MAJOR ACCOMPLISHMENTS IN 1984

Bennett, R. H.

Hosted an informal Code 360 planning meeting to address NORDA's plans in utilizing SeaMARC IV

NORDA hosted a meeting with TAMU and UT to discuss plans for using DTAGS to profile the fine-scale stratigraphy of the lower, deepwater, Mississippi Fan

Held an internal Code 360 meeting with all staff members to discuss major issues affecting research at NORDA. Topics discussed included:

- research/support objectives
- budgetary/financial/administrative restrictions
- facilities
- communications

Attended two meetings of the Joint Oceanographic Institutions' U. S. Science Support Committee

Made numerous professional presentations to promote NORDA visibility and technical expertise

Captured and completed new geacoustic modeling work for NSWC, White Oak, and the Theatre Nuclear Warfare Project Office

Expanded Code 360's efforts in the Bottom Interaction Program with a major emphasis on shallow water carbonate sediments

Initiated NORDA's first PhD Candidate Student Co-Op Program. This is a coordinated effort with NORDA's EEO Office and TAMU

In cooperation with TAMU completed a major study (phase I) of clay microstructure using techniques of Transmission Electron Microscopy. This study is in support of the Sandia National Laboratories' In Situ Heat Transfer Experiment (ISHTE)

Bowles, F. A.

Participated in High Frequency Acoustic Experiment with the Royal Australian Naval Research Laboratory and University of Washington Applied Physics Laboratory (APL)

Processed bathymetry from South Atlantic Geocorridor cruise

Constructed bathymetric contour map for area 30⁰ - 40⁰ in South Atlantic Geocorridor in preparation for FY 85 field operations

Conducted shakedown cruise on USNS LYNCH in preparation for FY 85 geocorridor operations

Completed major upgrade of deep-sea coring apparatus (with W. Jahn)

Wrote and submitted paper dealing with Orinoco/Amazon River input to eastern Caribbean

Burns, J. T.

Field tested three piezometers that are used in the joint NORDA/SANDIA In Situ Heat Transfer Experiment (ISHTE)

Installed and aligned NORDA's 100,000 volt Transmission Electron Microscope

Carnaggio, F.

Completed design of electronics package for sediment conductivity probe

Developed and implemented an interface/communication link between the sediment conductivity probe and an HP 85 computer

Fabricated, tested, calibrated, and prepared the diver-operated sediment conductivity probe for deployment in the Gulf of Mexico

Fabricated three CMOS microprocessor based 16-channel data acquisition systems for NORDA Code 333's Towed Underwater Pumping System (TUPS)

Designed and fabricated three precision multichannel amplifier interfaces for NORDA Code 333's TUPS

Egloff, J.

Provided practical management and editing control over the Defense Mapping Agency's Experimental Digitizing Project for Hydrographic Sounding Collection Sheets

Participated in the South Atlantic Geocorridor Geophysical Surveys from Montevideo to Tristan Island area

Einwich, A.

Reviewed all 3.5 kHz and 12 kHz records from previous legs of South Atlantic Cruise (1983-1984) to find and correct all major (and minor) errors in computerized data

Everard, W. H.

Participated in the South Atlantic Cruise on USNS BARTLETT

Interacted with Scripps to obtain six Ocean Bottom Seismograph Systems, and to plan a cooperative deployment cruise for June-July 1985

Participated in DTAGS cruise on RV COLUMBUS ISELIN

Fleischer, P.

Conducted geological characterization and site investigation for Mobile High Frequency Acoustic Scattering Experiment in Arafura Sea, in cooperation with APL-University of Washington, and Royal Australian Naval Research Laboratory

Conducted geological characterization and site selection and positioning (side-scan sonar, subbottom profiling, bathymetry, navigation) for NORDA High Frequency Acoustic Scattering Experiment (smooth bottom) off Panama City, FL

Conducted field exercise for NORDA's Quantitative Side-Scan Sonar (QS3) Program, with the NCSC Rail Facility at Panama City, FL

Gettrust, J. F.

NORDA lead in development of joint TAMU/NORDA SeaMARC IV program

Preliminary analysis of first DTAGS seismic data

Specified, gained funding support for multichannel seismic processing system

Grim, M.

Obtained and customized a contouring program to run on the VAX750, CALCOMP, and VERSATEC

Wrote several small programs for navigation and data display using VAX750, CALCOMP, and VERSATEC

Updated literature file on Southeastern U. S. Continental Margin Geology, and made geologic model of Cape Fear Arch area

Handschumacher, D.

Chief Scientist - South Atlantic Geocorridor: geomagnetics
seabeam (R/V Washington)
tectonics

Seven legs within the corridor-all geophysics

Swathmap Project: designed experiment
Gulf of Aden/Red Sea
coordinating geophysics

Cooperative work with:

Jeff Fox	URI	(S. Atlantic-tectonics)
Chris Harrison	U-MIAMI	(S. Atlantic-tectonics)
Wile Sciger	TAMU	(S. Pacific)
Tom Hilde	TAMU	(S. Pacific)

Lambert, D. N.

Prepared geoacoustic models for informal technical transmittal to the Theater Nuclear Warfare office: Environmental Surveys of Selected Sites

Co-developed (with F. Carnaggio) a new Self Contained and Diver Operated Conductivity/Resistivity Probe for the in situ measurement of seafloor conductivity and porosity

Established a new Geoacoustical Measurements Program of carbonate sediment and rock

Lavoie, D.

Prepared geoacoustic models for informal technical transmittal to the Theater Nuclear Warfare Office: Environmental Surveys of Selected Sites

Li, H.

For the investigation of the permeability, a marine sediment is modeled as a porous elastic matrix containing a viscous fluid. Based on the evaluation of

the piezometer data and the available solutions for the excess pore pressure dissipation, the permeability of marine sediments can be determined.

Based on two separate In Situ Heat Transfer Experiments (ISHTE) with piezometer (1981 and 1982), the results indicate that the maximum induced pore pressure is reduced for the piezometer probe near the heater probe. This reduction suggests that the sediment is weakened due to the heater probe emplacements. However, the degree of the reduction as well as the pore pressure dissipation are different for the two experiments. This suggests that the sediment (illite) is inhomogeneous and that a very complex deformation and stress distribution exists.

A research project entitled "Impact of Probe Insertion on the Measured Geotechnical Properties of Sediments" has been presented and accepted as a 6.1 'new initiative' for FY85

Madosik, S.

Completed training of two Digital Equipment Corp. classes

- a. Utilities and Commands
- b. System Management

Attended DECUS Symposium in Anaheim, CA.

Morgenthaler, E.

Processed and compiled all the data collected on the three South Atlantic Geo-Corridor cruises ('83-'84), including magnetics, navigation, and bathymetry records

Participated in South Pac Airmag Ops '84; approximately 30,000 miles of new aeromagnetic data was collected in the vicinity of Easter Island and the Chile-Triple-Junction

Processed and compiled the aeromagnetic data collected during South Pac Airmag Ops '84

Prepared and compiled preliminary data bases for South Atlantic Geo-Corridor Cruise '85

Nastav, F. L.

Researched, compiled data, prepared illustrations for inclusion in an informal technical transmittal for the Theater Nuclear Warfare Office: Environmental Surveys of Selected Sites

Compiled data for inclusion in an informal technical transmittal to Sandia National Laboratories: NORDA's Activities in the In Situ Heat Transfer Experiment (ISHTE) FY83 Annual Report

Compiled data for NORDA Tech Note 281: Seafloor Geosciences Division: Missions, Technical Specialties, Accomplishments, and Activities, Calendar Year 1983

Completed OPM Technical Writing Course

Completed OPM Basic Editing Workshop

Romero, G. C.

Prepared ISIMU (In Situ Heat Transfer Experiment Simulation) clay fabric samples for analysis in the Scanning Electron Microscope and the Transmission Electron Microscope

Trained in the operation of the Scanning Electron Microscope

Trained in the operation of the Transmission Electron Microscope

Spent ten weeks at sea, on the Mid-Atlantic Ridge, off Uruguay

Edited coordinates and bathymetry data on Defense Mapping Agency Charts

Sawyer, W.

Participated in bathymetric and side-scan sonar surveys at Panama City, FL for the High Frequency Forward and Backscatter Experiment conducted in September 1984

Participated in three legs of the South Atlantic Geocorridor Project

Participated in the High Frequency Acoustic Tower Acceptance Tests and subsequent deployments and retrievals at Panama City, FL

Prepared geoacoustic models for informal technical transmittal to the Theater Nuclear Warfare Office: Environmental Surveys of Selected Sites

Attended U. S. Army Basic Demolition School at Ft. Shelby, MS

Sellinger, C.

ISHTe data reduction program design:

Obtained readable data analysis (coordinated with Univ. of Wash. Applied Physics Laboratory [APL] and NORDA Code 362)

Created Fortran software package for data analysis (coordinated with Dr. Phil Valent, NORDA Code 363)

Wrote a co-program to plot data

Kings Bay Pre Assessment Study:

Performed a pre-survey historical work-up of area (necessary for up-coming 1985 work)

Co-authored a NORDA Report (with publication planned for Feb 85)

Orally presented information from previously mentioned NORDA Report at a Code 360 lecture seminar series

Physical Properties Measurements:

Collected cores in field during a four month period

Performed laboratory physical properties measurements on core samples

Designed software package for data analysis and graph display

Wrote a laboratory manual explaining lab procedures and use of computer-ready user programs

Currently writing and reviewing a NORDA Tech. Note

DSDP Data Reduction Program:

Assisted Code 363 with DSDP data input and analysis via digitizing data records, creating data files, providing precise contour maps, and compiling a final report

Valent, P. J.

Successfully fielded piezometer probes on ISHTE (In Situ Heat Transfer Experiment) component test platform at MPG-1 site, 1000km north of Hawaii at 5800m water depth (with J. Burns)

Successfully completed piezometer experiment at Sandia National Laboratories, Albuquerque, NM, and completed draft report of findings; determined that soil cracking around ISHTE heater probe did not extend to the depth of the heat source (with J. Burns)

Young, D. C.

Completed fabrication of sediment core cutter to be used in sediment analysis

Designed and fabricated portable velocimeter frame for field analysis of core, rock, and ice samples

Completed fabrication of gas equilibrators for NORDA Code 333's Chemical Fronts Project

Assisted in design of and fabricated a pH cell for NORDA Code 333

Assisted in various design phases of NORDA Code 333's TUPS (Towed Underwater Pumping System) Fish and instrumentation packages

Completed Basic FORTRAN course

Completed Introduction to the VAX course

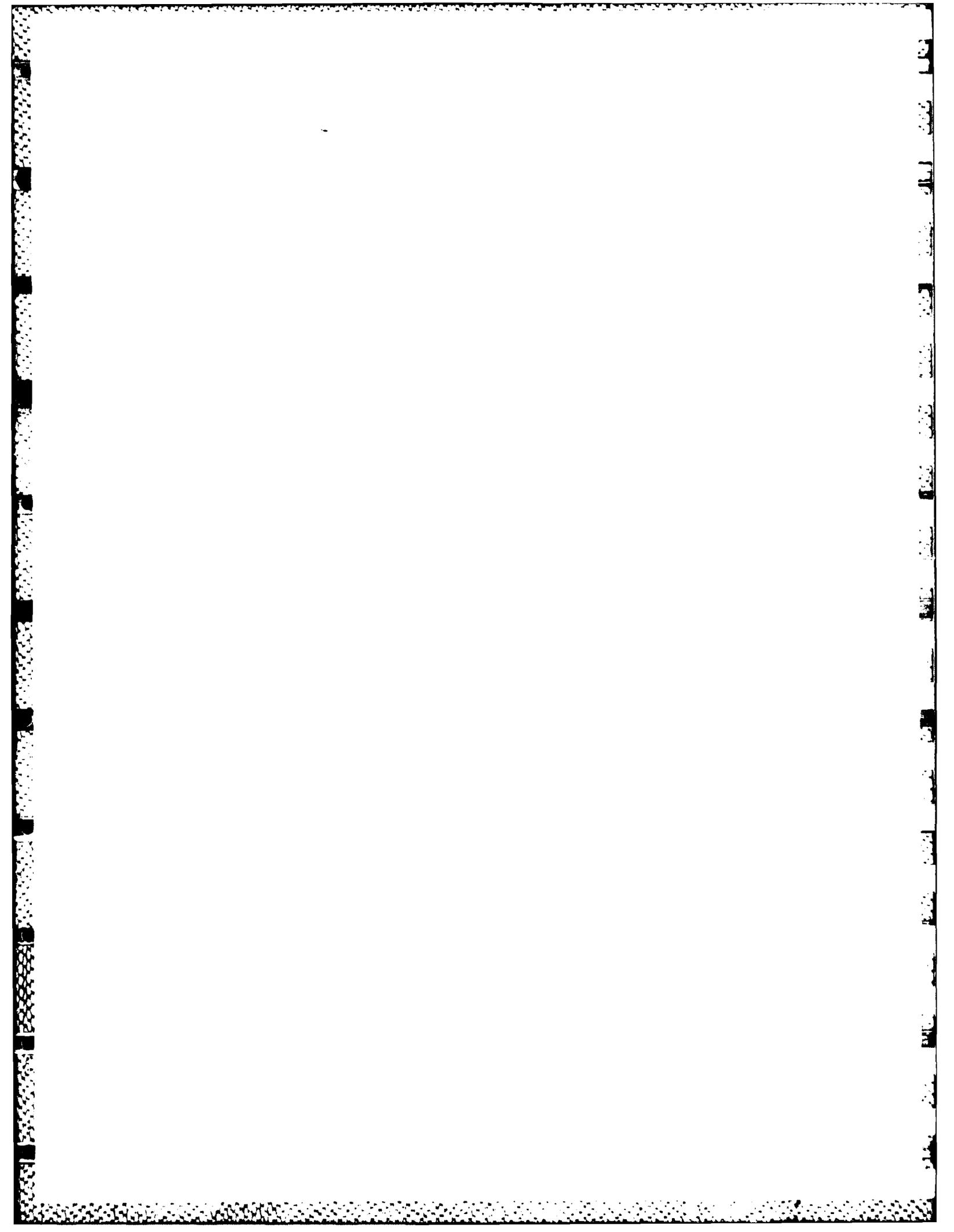
Designed and began fabrication of interchangeable type shear and compressional wave transducers

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) This informal report is a summary of the Seafloor Geosciences Division's research accomplishments and professional activities for calendar year 1984. The purpose is to provide NORDA Management and NORDA Offices (Codes) with a timely document on the Division's productivity, accomplishments and capabilities. The report also is intended to provide a means of information exchange to system commands, oceanography commands and other Navy activities requiring seafloor environmental data. In addition, the report is designed to increase communication channels with colleagues interested in Division activities. Most publications and reports cited are available from the authors. Communications are invited and should be directed to Division staff members and authors.				
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