

BUREAU OF ECONOMIC GEOLOGY

THE UNIVERSITY OF TEXAS AT AUSTIN



ANNUAL REPORT 1971

BUREAU OF ECONOMIC GEOLOGY

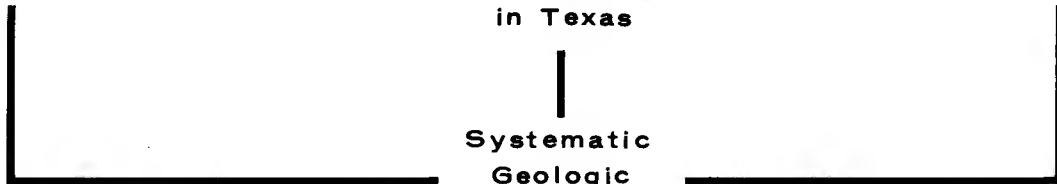
RESEARCH AND SERVICE IN GEOLOGY

Mineral Resources
Mineral Statistics
Mineral Information

Environmental
and Conservation
Problems

Basic
Geologic Research
in Texas

Systematic
Geologic
Mapping



**BUREAU OF ECONOMIC GEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
University Station, Box X
Austin, Texas 78712**

**RESEARCH AND ADMINISTRATIVE OFFICES
GEOLOGY BUILDING, MAIN CAMPUS**

**LABORATORIES
BALCONES RESEARCH CENTER**

BUREAU OF ECONOMIC GEOLOGY

The Bureau of Economic Geology is a research bureau of The University of Texas at Austin; it also functions as a State agency. Established in 1909, it has for 63 years been recognized as the Texas State Geological Survey; its Director fills the position of State Geologist.

The Bureau is engaged in research and public service in Texas geology. It carries on basic research to further understanding of the geology of and the natural earth processes that operate in the State. The applied program is focused on earth resources, environmental and conservation problems, and engineering problems. The Bureau's efforts in systematic geologic mapping are designed to produce geologic and special derivative maps at several scales for all those concerned with resources and land use in Texas. The Bureau participates in other University research efforts in the fields of resources and earth sciences including those of the Center for Research in Water Resources and the Marine Science Institute at Port Aransas. These two organizations, with the Bureau, constitute The University's Division of Natural Resources and Environment.

The Bureau publishes major reports in The University of Texas Publication series and maintains its own series of Reports of Investigations, Atlases, Geologic Quadrangle Maps, Geological Circulars, Mineral Resource Circulars, and Special Publications. A complete list of publications is available on request.

The geologic data developed by the Bureau of Economic Geology in the form of scientific reports and geologic maps are used by many State and Federal organizations in carrying out investigations in the public service. The Texas Water Development Board, Texas Highway Department, Parks and Wildlife Department, Texas Industrial Commission, Railroad Commission, The General Land Office, Interagency Natural Resources Council, and numerous other State departments, boards, conservation organizations, water districts, councils of government, and chambers of commerce utilize Bureau publications and services on both a formal and informal basis through interagency contracts and staff conferences. The Bureau also cooperates with Federal agencies, such as the Geological Survey, Bureau of Mines, Bureau of Reclamation, Corps of Engineers, and National Park Service. The mineral and geological information service offered by the Bureau of Economic Geology is used by public officials, private groups, corporations, and citizens through correspondence and conference.

PUBLICATIONS IN 1971*

Report of Investigations No. 69. GUM HOLLOW FAN DELTA, NUECES BAY, TEXAS, by J. H. McGowen. 91 pp., 35 figs., 8 pls., 4 tables, 31 detailed trench sections, January 1971 \$4.00

Processes active in a rapidly formed and presently forming fan delta along the north side of Nueces Bay are the subject of this report which documents one important type of bayhead infilling along the Texas coast. Gum Hollow fan delta is fed by a drainage network of 20 square miles with major sediment transport occurring during local thunderstorms or hurricane aftermath floods. Sedimentation rates are high, with as much as one-quarter million cubic yards being deposited during two days rainfall aftermath to Hurricane Beulah. Five land and three sub-aqueous environments are defined and the depositional processes and facies of each described. Gum Hollow fan delta is a depositional feature directly related to man's use of the land. General land use and some recommended erosion control measures are discussed in the report.

Report of Investigations No. 70. CORRELATION OF TERTIARY ROCK UNITS, WEST TEXAS, by Ross A. Maxwell and John W. Dietrich. 34 pp., 1 pl., January 1971 \$2.00

Tertiary sedimentary and volcanic rock units are traced or correlated throughout a wide area of West Texas, with special reference to the Big Bend National Park, the central and southern Davis Mountains, the Bofecillos and Barrilla Mountains, the Rim Rock Country, and the Chinati Mountains. Many of the formations are described from field examination; the bibliography of 40 references adds to the usefulness of the publication. The accompanying plate shows the detailed correlation of volcanic rocks in the Big Bend region of Texas.

Report of Investigations No. 71. STRATIGRAPHY OF LOWER CRETACEOUS TRINITY DEPOSITS OF CENTRAL TEXAS, by F. L. Stricklin, Jr., C. I. Smith, and F. E. Lozo. 63 pp., frontispiece, 14 figs., 15 pls., August 1971 \$2.50

Materials contained in this report represent data collected and synthesized as part of a long-term stratigraphic research program conducted by Shell Development Company between 1953 and 1959. The Lower Cretaceous formations of Central Texas are critical due to their extensive outcrop, their wide range of represented facies and environments, and their proximity to Lower Cretaceous hydrocarbon reservoirs in the Gulf Coast and to ground-water aquifers along the Balcones fault system. The report considers the stratigraphy of Trinity formations, with emphasis on lithology and boundary relations, environmental interpretations of stratigraphic intervals, and conclusions regarding broad aspects of early Cretaceous sedimentations.

*Prices do not include State/City sales tax; such tax is applicable to Texas residents.

Report of Investigations No. 72. VAN HORN SANDSTONE, WEST TEXAS: AN ALLUVIAL FAN MODEL FOR MINERAL EXPLORATION, by J. H. McGowen and C. G. Groat. 58 pp., 36 figs., August 1971 . . . \$1.00

Alluvial fans are hosts for a variety of mineral deposits, including uranium, diamonds, sand and gravel, and a suite of detrital heavy metallic ores such as gold, titanium, iron, and tin. They are important reservoirs of oil and gas in many basins. This report defines a detailed model of alluvial fan deposition, based on field mapping, facies analyses, and description of sedimentary structures of the Van Horn Sandstone (Precambrian or Cambrian) of West Texas. It represents the first detailed study of an ancient alluvial fan and should serve as a basic guide for interpretation and exploration of similar coarse-grained and gravel-bearing deposits.

Report of Investigations No. 73. DEPOSITIONAL SYSTEMS IN THE WOODBINE FORMATION (UPPER CRETACEOUS), NORTHEAST TEXAS, by William B. Oliver IV. 28 pp., 15 figs., November 1971 \$1.00

The Woodbine Formation of Northeast Texas has long been a major oil and gas producer. Among the many fields developed in the sands of the Woodbine is the giant East Texas field. This report, based on outcrop studies and the analysis of nearly 400 well records, outlines the major depositional facies and systems that make up the Woodbine, including fluvial, deltaic, and barrier bar-strandplain systems. Sand trends, facies relationships, facies composition, and the relation of facies to known and potential oil and gas reservoirs are shown in a series of maps, cross sections, and vertical sections.

Guidebook No. 12. URANIUM GEOLOGY AND MINES, SOUTH TEXAS, by D. Hoyer Eargle, George W. Hinds, and Alice M. D. Weeks. 61 pp., 21 figs., 2 pls., August 1971 \$1.75

In less than 20 years since the discovery of uranium in Karnes County, Texas has emerged as a major uranium-producing State. Proven reserves in excess of 6 million tons rank it third in the Nation. This guidebook outlines thoroughly the history, geology, and exploration of uranium in South Texas and includes a detailed two-day road log throughout the district. The report was prepared initially as a field trip guidebook for the 1971 meeting of the American Association of Petroleum Geologists in Houston.

Handbook No. 2. SULFUR IN TEXAS, by S. P. Ellison, Jr. 48 pp., 14 figs., 2 pls., 5 tables, February 1971. . \$2.00

Texas is the leading producer of sulfur. Value of Texas sulfur for many years has been second only to that of oil and gas produced in the State. Most of the sulfur produced in Texas is from underground deposits associated with cap-

rocks of buried salt plugs on the Gulf Coastal Plain; the Frasch method is used to recover elemental sulfur through wells drilled into the cap-rock.

This report discusses the history of sulfur, its uses and properties, mining and recovery methods, especially the Frasch method, and includes suggestions for pollution control and conservation with a look at the future of sulfur. The two plates show location of sulfur deposits and sulfur recovery plants from hydrogen sulfide.

Geological Circular No. 71-1. **RESOURCE CAPABILITY UNITS—THEIR UTILITY IN LAND- AND WATER-USE MANAGEMENT WITH EXAMPLES FROM THE TEXAS COASTAL ZONE**, by L. F. Brown, Jr., W. L. Fisher, A. W. Erxleben, and J. H. McGowen. 22 pp., 4 figs., November 1971 \$0.50

Growing concern over land and water resources, uses, and associated problems of environmental quality is leading toward accelerated Federal and State environmental protection and management legislation. If prudent, fair land- and water-use policies are to be developed, adequate inventories must be made of these resources, their composition, properties, and natural capacity for a variety of uses.

This report outlines (1) the nature of resource capability units—land, water, area of active process, biota, (2) the basic factors and properties exhibited by the units that define the limits of their use, and (3) the application of resource capability units to environmental management. Specific examples are shown for the 20,000 square miles of the Texas Coastal Zone, where a wide variety of resource units occurs in an area of diverse human activities.

Mineral Resource Circular No. 52. **THE MINERAL INDUSTRY OF TEXAS IN 1969**, by Owen W. Jones, F. F. Netzeband, and Roselle Girard. 36 pp. Reprint from U. S. Bureau of Mines Minerals Yearbook 1969, December 1970 [August 1971]. Free on request.

Value of Texas mineral production reached \$5.77 billion in 1969, up from \$5.5 billion in 1968. Texas remained the Nation's foremost producer of oil, natural gas, natural gas liquids, and magnesium metal, as well as a significant producer of cement, clays, gypsum, lignite, lime, salt, sand and gravel, stone, and sulfur. This report, prepared under a cooperative agreement between the U. S. Bureau of Mines and the Bureau of Economic Geology, gives salient mineral production statistics by commodity and by county.

PUBLICATIONS REPRINTED

The following publications were reprinted during 1971 and are again available for distribution.

Guidebook No. 2. **TEXAS FOSSILS, AN AMATEUR COLLECTOR'S HANDBOOK**, by W. H. Matthews III, 1960 (4th printing) \$1.00

Guidebook No. 7. **THE BIG BEND OF THE RIO GRANDE, A GUIDE TO THE ROCKS, LANDSCAPE, GEOLOGIC HISTORY, AND SETTLERS OF THE AREA OF BIG BEND NATIONAL PARK**, by Ross A. Maxwell, 1968 (3d printing) \$2.00

Special Publication. **DELTA SYSTEMS IN THE EXPLORATION FOR OIL AND GAS, A RESEARCH COLLOQUIUM**, by W. L. Fisher, L. F. Brown, Jr., A. J. Scott, and J. H. McGowen, 1969 (4th printing) \$5.00

Special Publication. **TEXAS MINERAL PRODUCERS (EXCLUSIVE OF OIL AND GAS)** [a directory],

compiled by Roselle Girard, 1970 (2d printing) \$1.25

Geological Circular No. 67-4. **DEPOSITIONAL SYSTEMS IN THE WILCOX GROUP OF TEXAS AND THEIR RELATIONSHIP TO OCCURRENCE OF OIL AND GAS**, by W. L. Fisher and J. H. McGowen, 1967 (2d printing) \$0.50

Geological Circular No. 69-4. **GEOMETRY AND DISTRIBUTION OF FLUVIAL AND DELTAIC SANDSTONES (PENNSYLVANIAN AND PERMIAN), NORTH-CENTRAL TEXAS**, by L. F. Brown, Jr., 1969 (2d printing) \$0.75

Geological Circular No. 70-4. **DEPOSITIONAL SYSTEMS IN THE JACKSON GROUP OF TEXAS—THEIR RELATIONSHIP TO OIL, GAS, AND URANIUM**, by W. L. Fisher, C. V. Proctor, Jr., W. E. Galloway, and J. S. Nagle, 1970 (2d printing) \$0.75

PUBLICATIONS IN PRESS

Environmental Geologic Atlas of the Texas Gulf Coast. GALVESTON-HOUSTON SHEET, by W. L. Fisher, J. H. McGowen, L. F. Brown, Jr. (project coordinator), and C. G. Groat.

Geologic Atlas of Texas. ABILENE SHEET. Frederick Byron Plummer Memorial Edition.

Geologic Atlas of Texas. DALLAS SHEET. Gayle Scott Memorial Edition.

Report of Investigations No. 74. EDWARDS GROUP, SURFACE AND SUBSURFACE, CENTRAL TEXAS, by Peter R. Rose.

Report of Investigations No. 75. DEPOSITIONAL SYSTEMS AND SHELF-SLOPE RELATIONSHIPS IN UPPER PENNSYLVANIAN ROCKS OF THE EASTERN SHELF, NORTH-CENTRAL TEXAS, by W.E. Galloway.

Report of Investigations No. 76. FOSSIL VERTEBRATES FROM THE LATE PLEISTOCENE INGLE-SIDE FAUNA, SAN PATRICIO COUNTY, TEXAS, by Ernest L. Lundelius, Jr.

Geological Circular No. 71-2. MINERAL DEPOSITS IN THE WEST CHINATI STOCK, CHINATI MOUNTAINS, PRESIDIO COUNTY, TEXAS, by W. N. McNulty, Sr.

OPEN-FILE REPORTS

The Bureau of Economic Geology maintains an open file of reports, maps, and manuscripts obtained from various sources. Some are unpublished, and others are progress reports of projects that ultimately will be published. These materials may be examined and copied, but publication rights are reserved.

The following items were placed on open file during 1971:

An Annotated Bibliography of Fauna and Flora Described from the Dockum Group of Triassic Age in Eastern New Mexico and West Texas, by James C. Wright and Warren I. Finch:

United States Geological Survey open-file report, 26 pp., 1971. Prepared by Warren I. Finch from rough copy that had been compiled by the late James C. Wright during late 1967 or early 1968.

Geologic Map and Sections of the Northern Franklin Mountains, Texas and New Mexico, by Robert L. Harbour: United States Geological Survey, 3 sheets, scale 1:24,000, 1971. Ozalid prints of a preliminary areal geologic map of the area north of El Paso, Texas, with graphic sections and cross sections of Precambrian and Paleozoic rocks.

PAPERS BY BUREAU OF ECONOMIC GEOLOGY STAFF IN SCIENTIFIC JOURNALS

- Barnes, V. E. (1971) Age of Asian tektites: *Geological Society of America Bulletin*, vol. 82, pp. 1995-1996.
- Brown, L. F., Jr. (1971) Virgil and Wolfcamp fluvial, deltaic, and interdeltic embayment depositional systems in North and West-central Texas (abstract): *American Association of Petroleum Geologists Bulletin*, vol. 55, pp. 151-152.
- Brown, L. F., Jr., and Galloway, W. E. (1971) Recognition of fluvial and deltaic sandstones of Pennsylvanian and Permian ages in North-central Texas (abstract): *American Association of Petroleum Geologists Bulletin*, vol. 55, p. 332.
- Fisher, W. L. (1971) Mineral resources and industries: *Texas Business Review*, vol. 45, pp. 4-8.
- Fisher, W. L. (1971) [Review of] Physical environments of Saskatoon, Canada: *Geotimes*, vol. 16, no. 3, pp. 31-32.
- Fisher, W. L. (1971) Tertiary depositional systems, Gulf of Mexico Basin (abstract): *American Association of Petroleum Geologists Bulletin*, vol. 55, pp. 152-153.
- Kennedy, J. M., and Wermund, E. G., Jr. (1971) The physical behavior of oil on water derived from airborne infrared and microwave radiometric measurements: *Photogrammetric Engineering*, vol. 37, no. 12.
- Margolis, S. V., Barnes, V. E., Cloud, Preston, and Fisher, R. V. (1971) Surface micrography of lunar fines compared with tektites and terrestrial volcanic analogs: *Proceedings of the Second Lunar Science Conference*, vol. 1, pp. 909-921, The MIT Press, Cambridge, Massachusetts.
- McGowen, J. H. (1971) Alluvial fans and fan deltas—depositional models of some terrigenous clastic wedges (abstract): *American Association of Petroleum Geologists Bulletin*, vol. 55, no. 1, p. 155; *Oklahoma Geology Notes*, vol. 31, no. 2, pp. 42-43.
- Shipman, R. L. (1971) Marine science at The University of Texas at Austin: *Quarterly Report of the Coastal Resources Management Program of the Division of Planning Coordination, Office of the Governor of Texas*, November.
- Wermund, E. G., Jr. (1971) Remote sensors for hydrogeologic prospecting in arid terrains: *I.E.E. Transactions in Geoscience Electronics*, vol. 9, pp. 120-131.

ADMINISTRATIVE CHANGES

Dr. W. L. Fisher, on January 1, 1971, became the sixth Director of the Bureau of Economic Geology after having served as Acting Director since August 1, 1970. He succeeds Dr. Peter T. Flawn who became Vice-President for Academic Affairs at The University of Texas at Austin. Fisher has endorsed the Bureau's traditional program of basic research with fundamental objectives or implications, and he is confident that this approach can be utilized to meet the steadily increasing environmental responsibilities assumed by the Bureau.

In May, Dr. L. F. Brown, Jr., was appointed Associate Director for Research, and Dr. Charles G. Groat was named Associate Director for Administration. These positions were restructured from

the former position of Associate Director.

Brown received his Ph.D. from the University of Wisconsin in 1955 and joined the Bureau staff in 1957 after working for the Standard Oil Company of Texas. He left the Bureau in 1960 to join the geology faculty of Baylor University and returned to the Bureau as a research scientist in 1966. Dr. Brown is also a professor of geology in the Department of Geological Sciences. Groat received his Ph.D. from The University of Texas at Austin in 1970. He became a permanent member of the Bureau staff in 1969 after working a year on the Bureau's Van Horn Sandstone project. Dr. Groat also is a lecturer in the Department of Geological Sciences.

NEW STAFF

Robert S. Kier

Staffing for the Geologic Atlas project was increased on September 1 with the addition of Robert S. Kier as a full-time staff member; Kier worked on the Atlas on a temporary basis during 1970 and earlier 1971.

Kier received his B.S. degree in 1965 and his M.S. degree in 1967 from Franklin and Marshall College in Pennsylvania. He is presently completing a Ph.D. dissertation at The University of Texas at Austin dealing with Carboniferous stratigraphy in eastern San Saba and western Lampasas counties.

Kier's professional interests include stratigraphy and sedimentary petrography. His current Bureau responsibilities are the completion of the Brownwood and Wichita Falls Sheets of the Texas Geologic Atlas.

Cleo V. Proctor, Jr.

Cleo V. Proctor, Jr., became a permanent member of the Bureau research staff on September 1 after having worked for the Bureau in several capacities on part-time and temporary bases. His past efforts at the Bureau were devoted to the Geologic Atlas and to stratigraphic studies of the Gulf Coast and East Texas basins. His presentation of Bureau work on the Jackson Group in Texas earned him a Best Paper Award at the 1970 Gulf Coast Association of Geological Societies meeting.

Proctor received his B.S. and M.S. degrees from Baylor University in 1961 and 1967, respectively; his Master's thesis was a geomorphic analysis of Central Texas watersheds. Prior to coming to The University of Texas at Austin for graduate studies in geology, Mr. Proctor worked in Libya with a geophysical service company. He anticipates receiving his Ph.D. degree in 1972.

Proctor's present research interests are focused on the central and eastern Texas Coastal Plain where he is mapping Pleistocene and Recent depositional facies as these relate to geologic history of the Texas Coastal Plain. He is also interested in quantitative geomorphology and the relationship of depositional facies to mineralization.

Ross L. Shipman

Ross L. Shipman, formerly assistant executive director of the American Geological Institute in Washington, D. C., joined the Bureau staff on February 1 as research program manager. During the period between his graduation from the University of Mississippi and his work at AGI, Mr. Shipman gained a wide variety of professional experience involving the economic geology of Texas—chiefly in oil and gas. He was employed by Humble Oil & Refining Company and served as district geologist in Wink, McCamey, Midland, and Odessa. He resigned from Humble in 1955 to become a geological consultant in Midland and later in Corpus Christi.

Mr. Shipman is a member of the American Association of Petroleum Geologists, Geological Society of America, American Institute of Professional Geologists, and the Geoscience Information Society. He was a founding member and served on the board of directors of the Society of Independent Professional Earth Scientists.

Shipman is employed half-time with the Bureau and half-time with The University's Division of Natural Resources and Environment.

Edmund G. Wermund, Jr.

E. G. Wermund, Jr., joined the Bureau research staff on October 1, bringing with him broad experience in carbonate stratigraphy and sedimentation, remote sensing, and computer applications to geology and resources. Wermund was a faculty member at Louisiana State University for three years before joining the Exploration Division of Mobil Research and Development Corporation in 1957. In 1970 he left Mobil to take charge of developing programs for Remote Sensing, Inc., in Houston. He recently served as a consultant to the United Nations for remote sensing, geological engineering, and water location in connection with the Trans-Saharan Highway.

Wermund received a B.S. degree in geology from Franklin and Marshall College in 1948 and did graduate work at Washington University before

attending Louisiana State University where he received a Ph.D. degree in 1961. He is a member of several professional organizations and has authored or co-authored more than 20 scientific reports.

As a research geologist with the Bureau, Wermund

will continue research in carbonate stratigraphy and sedimentation and conduct resource-oriented projects. He will also coordinate a program for the computerization of the Bureau's extensive environmental mapping projects.



New research staff members. From left to right: R. S. Kier, C. V. Proctor, Jr., R. L. Shipman, E. G. Wermund, Jr.

RODDA LEAVES

Dr. Peter U. Rodda, Research Scientist with the Bureau of Economic Geology, resigned in August to become curator of geology at the California Academy of Sciences in San Francisco. Rodda joined the Bureau staff in 1958. His principal research involved stratigraphy, paleontology, and mineral resources of the Lower Cretaceous rocks. He was the initial coordinator of the Austin area environmental geology study, currently being completed. During his

13-year stay at the Bureau, Rodda published numerous geologic reports and was curator of type and working fossil collections. He is a Fellow of the Geological Society of America and a member of numerous professional organizations. He was an associate professor of geological sciences at The University of Texas at Austin where he taught paleobiology and historical geology.

BUREAU OF ECONOMIC GEOLOGY CURRENT PROJECTS

Basic Geology

Gulf Coast Basin

Depositional Systems in the Texas Gulf Coast Basin. W. L. Fisher, J. H. McGowen, C. V. Proctor, Jr., and graduate research assistants. A series of long-term studies of major stratigraphic units in the Gulf Coast Basin. Current investigations include *Depositional Systems of the Pleistocene of the Upper Texas Coast—Their Environmental Significance*, by C. V. Proctor, Jr., in which basic geologic-facies mapping and subsurface data are utilized to relate depositional facies to significant environmental factors. The first phase of this project—basic geologic-facies mapping—was initiated in 1971 and will be completed in 1972.

Another of the current investigations of the depositional systems of the Texas Gulf Coast Basin is *Depositional Systems of the Texas Upper Cretaceous Sands*, by W. L. Fisher and C. V. Proctor, Jr. Subsurface data are utilized in conjunction with outcrop mapping to reconstruct the principal depositional systems and to relate these to known and probable mineral occurrences. This project was initiated in 1970 and will be completed during 1972.

Regional surface and subsurface studies of the Queen City Formation by E. H. Guevara and Roberto Garcia under the supervision of L. F. Brown, Jr., and W. L. Fisher are nearing completion. Principal deltaic and strike systems have been mapped and defined. Scheduled completion is during 1972.

Llano Region of Central Texas

Relict Paleozoic Formations of Central Texas. V. E. Barnes and others. A long-term project concerning rocks and fossils of the geologic formations that make up the sequence from the top of the Ellenburger Group to the base of the Marble Falls Limestone. Results of the study are presented as a series of separate papers—most have now been published. As a part of the project, A. J. Boucot is currently investigating brachiopods obtained from these rocks.

The Moore Hollow Group of Central Texas. V. E. Barnes and W. C. Bell. The stratigraphic portion of the report on this study of Cambrian rocks and contiguous overlying strata was completed in 1960. The paleontologic portion is scheduled for completion early in 1972.

North-central Texas

Deposition of Upper Pennsylvanian—Lower Permian Rocks of North-central Texas. L. F. Brown, Jr., assisted by T. H. Waller, J. R. Ray, and Mary Seals. Development of a model of depositional facies, based on outcrop and shallow subsurface data, for the type area of Cisco rocks. The project includes detailed outcrop mapping and stratigraphic-depositional studies for a 1,500-foot rock section in a 1,200-square-mile area of north-central Texas. Numerous publications have resulted from this project, which will be finalized upon completion of additional mapping. The project was initiated in 1967.

Virgil-Wolfcamp Facies, Eastern Shelf, North-central Texas. L. F. Brown, Jr., assisted during 1971 by Rafik Salem and Roberto Garcia. Regional surface and subsurface study of a 30-county area of north-central Texas, involving the examination of approximately 10,000 well logs. Goal of the project is mapping and recognition of fluvial, deltaic, and related marine depositional systems and their component facies. The resulting regional picture of Late Pennsylvanian and Early Permian depositional features will serve as a guide in the search for oil, water, clay, and other resources in the study area and in similar depositional systems elsewhere. Comparison with modern analogs is a significant part of this study. Project was initiated in 1968 and has progressed to the point that synoptic maps and cross sections are in advanced stages of preparation. Completion is expected in late 1972.

West Texas

Upper Pennsylvanian and Lowermost Permian Limestones of the Central Basin Platform in Texas. E. G. Wermund. Subsurface study of Late Pennsylvanian and Early Permian carbonate environments in a major oil- and gas-producing province. Logs, well cuttings, and cores will be correlated and the petrology of carbonate samples studied. Well locations, depth to formations, and rock types in the samples will be formulated for computer mapping. This investigation will be the pilot project for computer processing of geologic data by the Bureau of Economic Geology. The project was initiated in November 1971.

Tektites

Tektites. V. E. Barnes. Research on world tektites and natural glasses supported since 1960 by the National Science Foundation. Two papers resulting from this study were published during 1971. One, entitled "Age of Asian Tektites," is in *Geological Society of America Bulletin*, vol. 82, pp. 1995-1996. The other, "Surface Micrography of Lunar Fines Compared With Tektites and Terrestrial Volcanic Analogs," written jointly with S. V. Margolis, P. E. Cloud, and R. V. Fisher, is included in the *Proceedings of the Second Lunar Science Conference*, vol. 1, pp. 909-921, The MIT Press, Cambridge, Massachusetts. In press is an additional paper, "Description and Origin of Large Tektite from Thailand," that will be included in a volume honoring Professor Fritz Heide, Jena, East Germany, on his 80th birthday.

Environmental Geology

Environmental Geologic Atlas of the Texas Gulf Coast. L. F. Brown, Jr., W. L. Fisher, C. G. Groat, J. H. McGowen, and C. V. Proctor, Jr. Status of this project is outlined elsewhere in this Report.

Geology of Austin and Vicinity. L. E. Garner. A study of the geology of the Austin area and of physical properties of the rock units. The project is designed to provide data for planners, engineers, and other interested persons. Field mapping by

L. E. Garner, P. U. Rodda, K. P. Young, and other geologists is complete. Basic data have been compiled as a geologic map at a scale of one inch equals approximately one mile. The map will be published as a single sheet. Engineering data were obtained from State and Municipal agencies and private firms.

Derivative land-use maps and special-purpose maps of the entire Austin area have been completed and will accompany the final report. Included are maps showing engineering properties (slope stability, permeability, excavation potential, shrink-swell potential, corrosion potential), slope intensity, current land use, and surficial deposits. The final report is scheduled for completion in 1972.

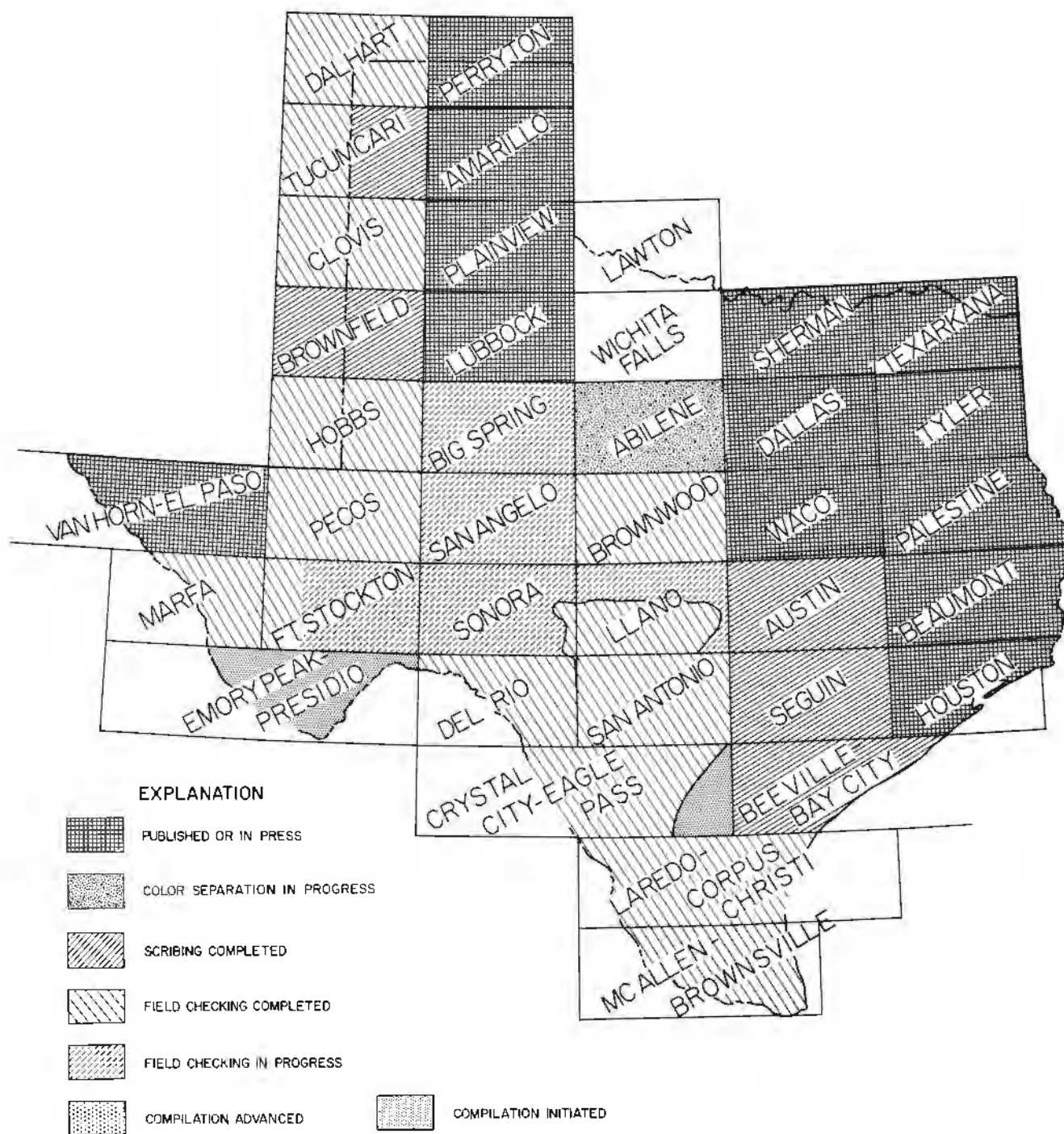
Matagorda Bay and Environs—A Pilot Program for Land- and Water-Use Management. J. H. McGowen, project coordinator, with Lee McKibben, Scooter Cheatham, and Judy Roby, of The General Land Office, and J. L. Brewton and R. W. Nordquist, of the Bureau of Economic Geology. The project is described elsewhere in this Report.

Environmental Geology of the Austin—San Antonio Area. P. H. Townsend. Collection of data necessary for informed environmental management of the study area. Data, to be presented on maps with accompanying text, include engineering properties, ground-water conditions, construction materials, mineral resources, and waste-disposal conditions. These data are related to regional geology and to the past, present, and future economic conditions. Manuscript is in preparation. (Doctoral dissertation supervised by P. T. Flawn and partly supported by the Bureau of Economic Geology.)

Open-Pit Mining in Texas: Inventory and Environmental Effects. C. G. Groat, assisted by Stephen D. Etter and Jeffrey C. Reid. The project is described elsewhere in this Report.

Geologic Mapping

Geologic Atlas of Texas. V. E. Barnes and others. The preparation of a geologic map of the State to be issued as a series of 37 separate 1° x 2° sheets at a scale of 1:250,000. This long-term



Current status of Texas Geologic Atlas

project continues with support and cooperation of various geological societies, oil companies, and other organizations.

Twelve sheets of the Atlas have been published. The Dallas Sheet is in press, and the Abilene Sheet will be in press in 1972. Review of the Austin and Seguin Sheets is completed; when final corrections are made, the sheets will be ready for color separation. The Beeville—Bay City Sheet, which has been scribed for several years, is awaiting completion of the Bureau's Environmental Geologic Atlas of the Texas Coastal Zone in order to add features that will make the sheet more useful. The Brownfield Sheet has been scribed and sent to the Review Committee of the West Texas Geological Society.

The New Mexico State Bureau of Mines and Mineral Resources is cooperating in the preparation of sheets common to Texas and New Mexico. During the summer, C. C. Reeves, Jr., completed the New Mexico portion of the Hobbs Sheet.

In Texas, geologists of the Bureau of Economic Geology have completed field checking the Brownwood, Del Rio, Laredo—Corpus Christi, McAllen—Brownsville, Pecos, and San Antonio Sheets, and only a small portion of the Crystal City—Eagle Pass Sheet remains to be field checked. Field checking is continuing on the Big Spring Sheet and has been initiated on the Emory Peak—Presidio, San Angelo, and Wichita Falls—Lawton Sheets. Peter U. Rodda initiated field checking of Cretaceous rocks for the Fort Stockton and Sonora Sheets.

Geologists who worked on the Atlas during the year include V. E. Barnes, project director, G. K. Eifler, Jr., P. U. Rodda, L. F. Brown, Jr., J. L. Brewton, N. B. Waechter, R. S. Kier, E. M. P. Lovejoy, J. B. Brown, and A. W. Cleaves. The Geologic Atlas of Texas project is in part supported through an interagency contract with the Texas Water Development Board.

Geologic Quadrangle Mapping in Llano Region of Central Texas. V. E. Barnes and R. H. McGehee. The preparation of geologic maps, with accompanying texts, of areas in Blanco, Burnet, and Llano counties. McGehee has compiled the Precambrian geology for the Cap Mountain, Click, Dunman Mountain, and Kingsland quadrangles, and Barnes has mapped the Paleozoic rocks and written explanatory texts for each of the quadrangles. In addition, McGehee has pre-

pared a comprehensive report on the Precambrian geology of the four quadrangles that will be accompanied by a large-scale map of the Precambrian rocks only. Barnes has mapped geologically the Hammetts Crossing, Howell Mountain, Longhorn Cavern, Marble Falls, Pedernales Falls, Round Mountain, and Spicewood quadrangles. Texts for these quadrangles are in various stages of completion.

Mineral Resources and Mineral Statistics

Permian Red-Bed Copper Deposits, North Texas—A Preliminary Report. W. E. Galloway and L. F. Brown, Jr. Aim of the project is to compile available data on red-bed copper deposits of North Texas and to consider the distribution and origin of the copper in relation to the depositional facies within the host Permian deltaic and mudflat deposits. The project was initiated by W. E. Galloway in 1970; a preliminary manuscript has been prepared.

Mineral Atlas of Texas. R. M. Girard and W. R. Stearns, assisted in 1971 by Shirley J. Dreiss. The preparation of a series of maps of the State showing locations of (1) mines, quarries, and prospects; (2) occurrences of metals, nonmetals, asphalt, and coals; (3) oil and gas fields; (4) principal power and transportation facilities; (5) mineral processing and manufacturing facilities, including smelters and cement, ceramic, and lime plants. During the summer of 1971, locations of metal and coal mines, prospects, and occurrences were plotted on base maps, scale 1:500,000, issued by the United States Geological Survey. The project was initiated June 1, 1971.

Mineral Production in Texas. R. M. Girard, in cooperation with the United States Bureau of Mines. Annual compilation of Texas mineral production data and other mineral information. During 1971, a report on 1970 production of industrial minerals in Texas was prepared for inclusion in the Texas chapter of the United States Bureau of Mines *Minerals Yearbook, 1970*. A preprint of the chapter will be issued as Bureau of Economic Geology Mineral Resource Circular No. 53, "The Mineral Industry of Texas in 1970."

Asbestos in the Van Horn—Allamoore Talc District.

C. G. Groat. Study of the occurrence of long-fiber asbestos in talcose rocks; project was initiated as a result of the discovery by prospectors of high-grade asbestos in the central part of the district. Completion scheduled for 1972.

Regional Geologic and Geochemical Study of Trans-Pecos Texas with Emphasis on the Occurrence of Mineral Deposits.

C. G. Groat, assisted in 1971 by J. C. Gries and Susan Deutsch. The project involves an extensive compilation of existing geological information to be used in a synthesis relating the occurrence of mineral deposits to regional structural, stratigraphic, igneous, and geochemical controls. Initial geochemical sampling has been completed, with concentration in the Chinati, Quitman, and Wylie Mountains and nearby areas. One of the chief aims of the project is to develop a model that will aid in prospecting in the area.

Talc Deposits of the Allamoore District, Texas.

R. G. Rohrbacher. A study of the occurrence, origin, and distribution of talc deposits in Precambrian rocks of the Allamoore area, Culberson and Hudspeth counties, Texas. Includes detailed mapping, petrography, and geochemistry of the talc deposits and associated rocks. (Doctoral

dissertation partly supported by the Bureau of Economic Geology.)

Texas Public Lands—Estimate of Future Oil and Gas Production from Established Fields: Texas Gulf Coast, Offshore, Bays, and Estuaries.

W. R. Stearns. This investigation of the oil and gas reserves of State-owned lands in the Gulf Coast and offshore area is part of a long-term project to survey and evaluate the mineral resources of all lands owned by the State of Texas. The necessary oil and gas data have been acquired and processed; publication of the portion of the study area pertaining to the lower coastal area is anticipated for 1972. The project was initiated in 1969.

Miscellaneous Bibliographies and Indices

Bibliography and Index of Texas Geology, 1951-

1960. E. T. Moore. All data have been compiled and final editing is nearly complete.

Addendum to Index to Well Samples. M. L. Morrow.

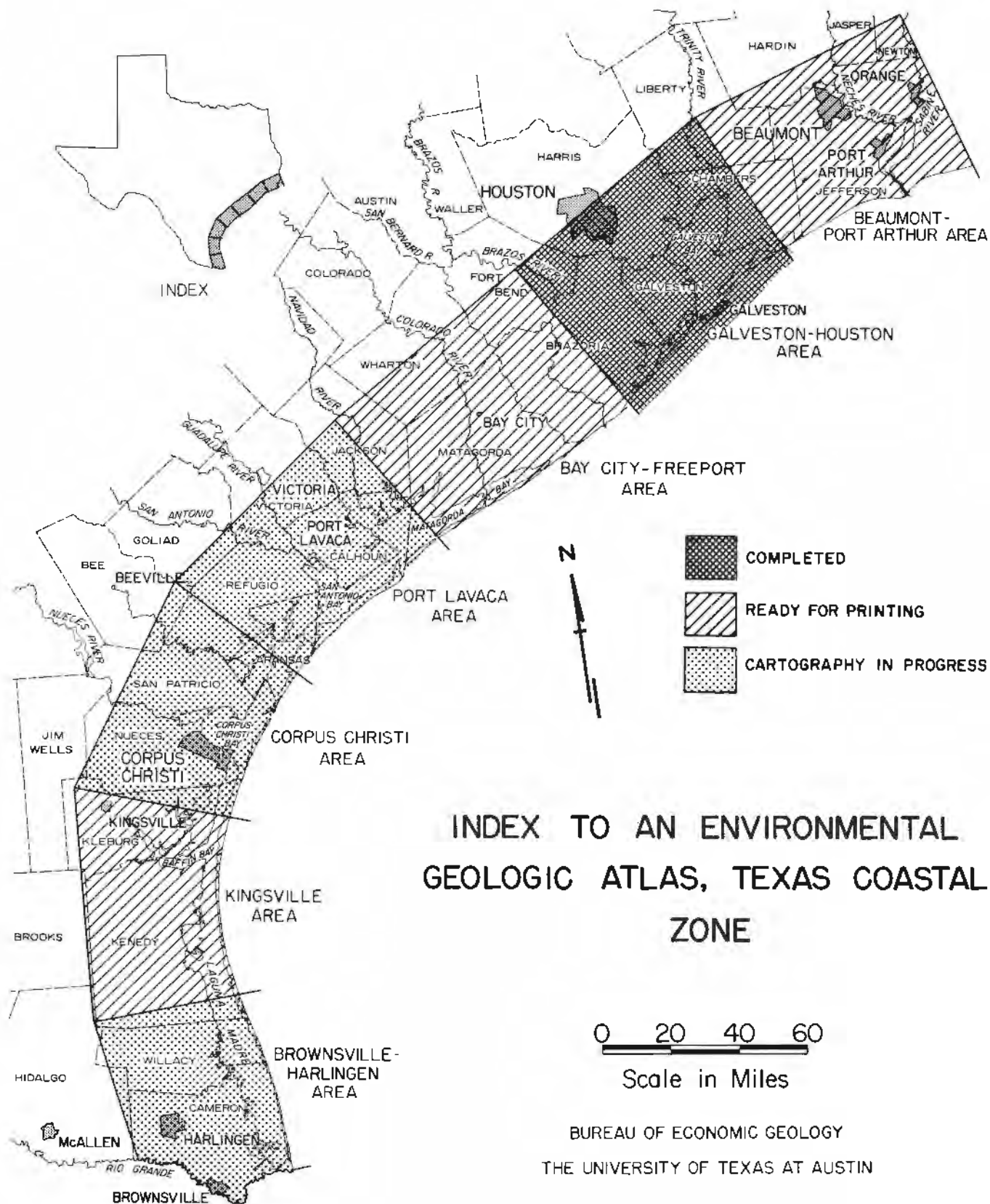
Compilation of data on materials received in 1970 and 1971 is continuing. Publication is scheduled for 1972.

ENVIRONMENTAL GEOLOGIC ATLAS OF THE TEXAS COASTAL ZONE

The Environmental Geologic Atlas of the Texas Coastal Zone, consisting of seven separate folios, is nearing completion. The first folio in the Atlas—the Galveston-Houston Sheet—is being printed and will be issued early in 1972. Subsequent sheets will be issued at approximately two-month intervals. Each folio consists of a basic Environmental Geologic Map, at a scale of 1:125,000, and a series of eight Special-Use Maps, at a scale of 1:250,000. All are in full color and on a specially constructed base. Each folio will be accompanied by a descriptive text.

The Environmental Geologic Atlas of the Coastal Zone is the product of an extensive study of the Coastal Zone conducted by the Bureau of Economic Geology during the past two years. Atlas coordinator is L. F. Brown, Jr., Bureau Associate Director for Research; other participants include

W. L. Fisher, J. H. McGowen, C. G. Groat, C. V. Proctor, Jr., and several research assistants. The Atlas covers approximately 20,000 square miles of the Texas Coastal Zone within an area extending from about the 5-fathom line offshore to 50 miles inland. Mapping was accomplished by the use of detailed photographic mosaics, topographic maps, and existing maps of many types. Photo-mapping was supplemented by many hours of low-level aerial reconnaissance and selected field studies. The Special-Use Maps were derived from basic mapping and from compilation of diverse existing data. The Environmental Geologic Atlas is designed to provide a thorough inventory of natural and man-made resources of the Coastal Zone and to serve as a basic document in planning, development, and conservation of the Texas Coast.



The Atlas consists of the following seven folios, listed in the order of scheduled publication (see *index map*):

Galveston-Houston Sheet
Beaumont—Port Arthur Sheet
Kingsville Sheet
Bay City—Freeport Sheet
Port Lavaca Sheet
Corpus Christi Sheet
Brownsville-Harlingen Sheet

Each folio includes the following complement of maps:

(1) *Basic Environmental Geologic Map*: Prepared at a scale of 1:24,000 and published at a scale of 1:125,000. A total of 130 separate resource units is shown on these maps, including physical units (geologic substrate and soils), biologic units, active and potentially active physical-process units, and man-made units.

(2) *Special-Use Environmental Maps*: A series of eight special-use maps, derived from the Basic Environmental Geologic Map and supplemented by compilation of data from diverse sources. These maps are at scale of 1:250,000.

Physical Properties Map: Characteristics of substrate, soils, and landforms for specific physical uses such as engineering, construction, and waste disposal. Coastal lands are graded in 15 separate categories according to physical properties and appropriate physical use. Zones of active and potentially active faults are indicated. Existing pits, quarries, sludge pits, sewage disposal sites, solid-waste disposal sites, and shallow piercement salt domes are plotted.

Mineral and Energy Resources Map: Shows occurrence and distribution of major mineral resources, including oil and gas fields, sulfur, salt, shell reefs, constructional fill. Also indicated are pits and quarries, LPG storage sites, salt and sulfur mines, cement and lime plants, power generating plants, utility lines, pipelines, and offshore production platforms.

Environments and Biologic Assemblages Map: Occurrence and distribution of 45 natural environments and biologic assemblages. These include on-land vegetational zones and benthonic assemblages of bays, estuaries, and offshore areas.

Man-Made Features and Water Systems Map: Delineation of natural water bodies by type, artificial water bodies (reservoirs and drainage, irrigation, and transportation canals), and principal features constructed or altered by man.

Active Processes Map: Characterization of bay and open-gulf shorelines as erosional, depositional, or stabilized (both natural and man-made stabilization); high-energy subaqueous zones; areas of rapid deposition in bays, estuaries, and open gulf; sites of active or potential hurricane washovers; and areas inundated by hurricane storm surges and aftermath flooding.

Current Land Use Map: Delineation of 25 major types of land use within such major categories as agricultural lands, range-pasture, woodland-timber, swamp-timber, wetlands (salt, brackish, and fresh-water marsh), residential-urban areas, recreational areas, and industrial areas. Also indicated are sulfur and brine production sites, pits and quarries, sludge pits, sewage-disposal sites, solid-waste disposal sites, pipelines, airfields, and artificial surface reservoirs.

Rainfall, Stream Discharge, and Surface Salinity Map: Monitoring stations, rainfall, discharge, and surface salinity graphs; and contours of bay salinities for humid, drought, and normal seasons.

Topography and Bathymetry Map: Shaded relief map of landforms shown at 5-foot contour intervals derived from detailed 7.5-minute topographic base maps; shaded bathymetry of bays, estuaries, and offshore areas at 1-fathom intervals.

Preliminary data from the Environmental Geologic Atlas have been utilized by numerous State and Federal agencies, local governmental groups and authorities, as well as several university and private groups. Staff members of the Bureau outlined the scope and preliminary data of the project to more than 100 different groups during 1971. Basic data from the Coastal Zone study were used to establish resource capability units in development of operational guidelines for Coastal Zone management. These are included in an interim report of the Coastal Resources Management Program of the Interagency Council on Natural Resources and Environment, Office of the Governor.

Plans are currently being formulated by the Bureau of Economic Geology to extend its environmental mapping program to State-wide coverage. Such a program will provide adequate inventory of the kind, grade, and distribution of land and water resources and their capability for various levels of use. Inventory and delineation of the State's resources can be basic to the development of prudent and fair land-use policies and to a logical management of natural resources that will permit needed development consistent with desirable environmental quality.

RESOURCES CAPABILITY UNITS		ACTIVITIES	Liquid Waste Disposal		Solid Waste Disposal		Coastal Construction				Inland Construction				Spoil Disposal ★		Excavation (includes extraction of natural materials)		Filling for Development		Drainage of Wetlands		Well Development		Dredging		Transferring with Vehicles (marsh buggies, air boats, dune buggies, motorcycles)		Use of Herbicides, Pesticides, Insecticides	
			Surface Disposal of Untreated Liquid Wastes	Disposal of Untreated Liquid Wastes, Subsurface, Shallow	Maintenance of Feed Lots	Disposal of Solid Waste Materials	Construction of Offshore and Bay Platforms	Construction of Jetties, Groins, Piers	Construction of Storm Barriers and/or Seawalls	Placement of Pipelines and/or Subsurface Cables ▲	Light Construction	Construction of Highways	Heavy Construction	Flooding (through dam construction)	Drilling of Canals and Channels, and Spoil Disposal	Excavation (includes extraction of natural materials)	Filling for Development	Drainage of Wetlands	Well Development	Dredging	Transferring with Vehicles (marsh buggies, air boats, dune buggies, motorcycles)	Use of Herbicides, Pesticides, Insecticides								
WATER CAPABILITY UNITS	Bays, Estuaries, and Lagoons	River Influenced Bay Areas Including Prodelta and Delta Front	X	X		X	0	0	X	0					X	X	X	0												
		Enclosed Bay Areas	X	X		X	0		X	0					0	0	0													
		Living Oyster Reefs and Related Areas	X	X		X	X	X	X	X					X	X	X													
		Dead Oyster and Serpulid Reefs and Related Areas	X	X		X	0	0	X	0					X	X	X													
		Grassflats	X	X		X	X	X	X	X					X	X	X													
		Mobile Bay Margin Sand Areas	X	X		X	X	X	X	X					X	X	X													
		Tidally Influenced Open Bay Areas	X	X		X	0	0	X	0					X	X	X													
		Subaqueous Spoil Areas	X	X		X	0	0		0							0	0												
		Inlet and Tidal Delta Areas	X	X		X	X	X	X	X					X	X	X													
		Tidal Flats	X	X		X			X	X	X	X	X		0	X	X													
LAND CAPABILITY UNITS	Coastal Wetlands	Salt-Water Marsh	X			X	X		X	X	X	X	X	X	X	X	X	X	0	X	X	X								
		Fresh-Water Marsh	X			X			X	0	X	X	X	X	X	X	X	X	X	0	X	X	X							
		Swamps	X			X			0	X	X	X	X	0	0	X	X	0	X	0	X									
	Coastal Barriers	Beach and Shoreface	X	X		X		X	0		X	X	X		X	X			X	0										
		Fore-Island Dunes and Vegetated Barrier Flats	X	X	X	X		X		+	+	+		X	X				0	X	X	X								
		Washover Areas	X	X	X	X		X	X	X	X	X	X		X		X													
		Blowouts and Back-Island Dune Fields	X	X		X			0	X	X	X	X		X				X											
		Wind Tidal Flats	X	X		X					X	X	X		0	X		0												
	Man-Made	Swales	X	X		X					X	X	X		X	X	X	X		X	X									
		Made Land and Spoil	X	X	X	X							0																	
		Highly Permeable Sands	X	X	X	X									0	X				0	X									
		Moderately Permeable Sands	X	X	X	X									0	X				0	X									
	Coastal Plains	Impermeable Muds	0							0	0	0	0						0											
		Broad Shallow Depressions *	0								X	0	X						0											
		Highly Forested Upland Areas *												X					0	X										
		Steep Lands, Locally High Relief	X			X					0	0			X				X											
		Stabilized Dunes	X	X	X	X						0			X	X			0	X	X	X								
		Unstabilized, Unvegetated Dunes	X	X		X			0	X	X	X	X		X				X											
		Fresh-Water Lakes, Ponds, Sloughs, Playas	X			X									X		X	X	0											
		Mainland Beaches	X	X		X		X	X		X	X	X		X	X	X		X	0										
		Areas of Active Faulting and Subsidence	0	0		0			X	0	0	X							0											
		Major Floodplain Systems	Point-Bar Sands	X	X	X	X				0					X				0	X									
	Overbank Muds and Silts		X	X	X	X				0	0	0	0	0																
	Water		X			X								0	X															

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X Undesirable (will require special planning and engineering)
 + Possible problem(s)
 * Barrier Flat only (no construction on dunes)

▲ Substrate variable
 Also occurs in Offshore Construction
 ★ Also occurs in Offshore Canals and Dredging

Coastal Zone resource units—use and capabilities.
(From Bureau of Economic Geology Geological Circular No. 71-1, page 8.)

COASTAL RESOURCES MANAGEMENT PROGRAM

During 1971, the Bureau of Economic Geology participated in an interdisciplinary research team at The University of Texas at Austin formed to determine operational guidelines for effective management of the Texas Coastal Zone. The research team was established at the request of the Governor's Office and is supported by the Division of Planning Coordination of that Office. During the summer, team members prepared an interim report as a part of the Coastal Resources Management Program of the Interagency Council on Natural Resources and Environment.

The Bureau's principal input for the team report was drawn from its extensive environmental mapping program in the Texas Coastal Zone. Based on this work, land and water units were considered in terms of their natural capacity to sustain various uses. Thirty-four major land and water units were grouped from more than 130 mapped units.

Principal team members include Drs. E. Gus Fruh and Joseph F. Malina, Jr., of The University's Department of Civil Engineering and Environmental Health Engineering Laboratories; Dr. Carl H. Oppenheimer, Marine Science Institute at Port Aransas; Dr. Jared Hazelton, Department of Economics; and Dr. W. L. Fisher, Bureau of Economic Geology. Additional input and coordination were made by Mr. James T. Goodwin, Coordinator of Natural Resources for the Division of Planning Coordination of the Governor's Office.

During the past two years, the Bureau has worked closely with the Coastal Resources Management Program, coordinating the results of Bureau research in the Coastal Zone with the objectives of the State's program.

OPEN-PIT MINING STUDY INITIATED

An inventory of all pits and quarries developed for the purpose of mining earth resources was initiated in October. Supported by the Division of Natural Resources and Environment of The University of Texas at Austin, this project will include locating all active and inactive pits on base maps and describing the mines with regard to size, yearly expansion, and effects of the mining operations on the environment.

The study was motivated by the need for up-to-date, accurate information on the extent of surface mining in Texas to provide a quantitative base for evaluation of proposed Federal and State legislation seeking to regulate open-pit mining.

In addition to providing data on surface mining, the study will also update Bureau information on mineral-resource production. All data will be collected and compiled so as to provide ready access by persons or agencies interested in the surface-mining or resource aspects of the project.

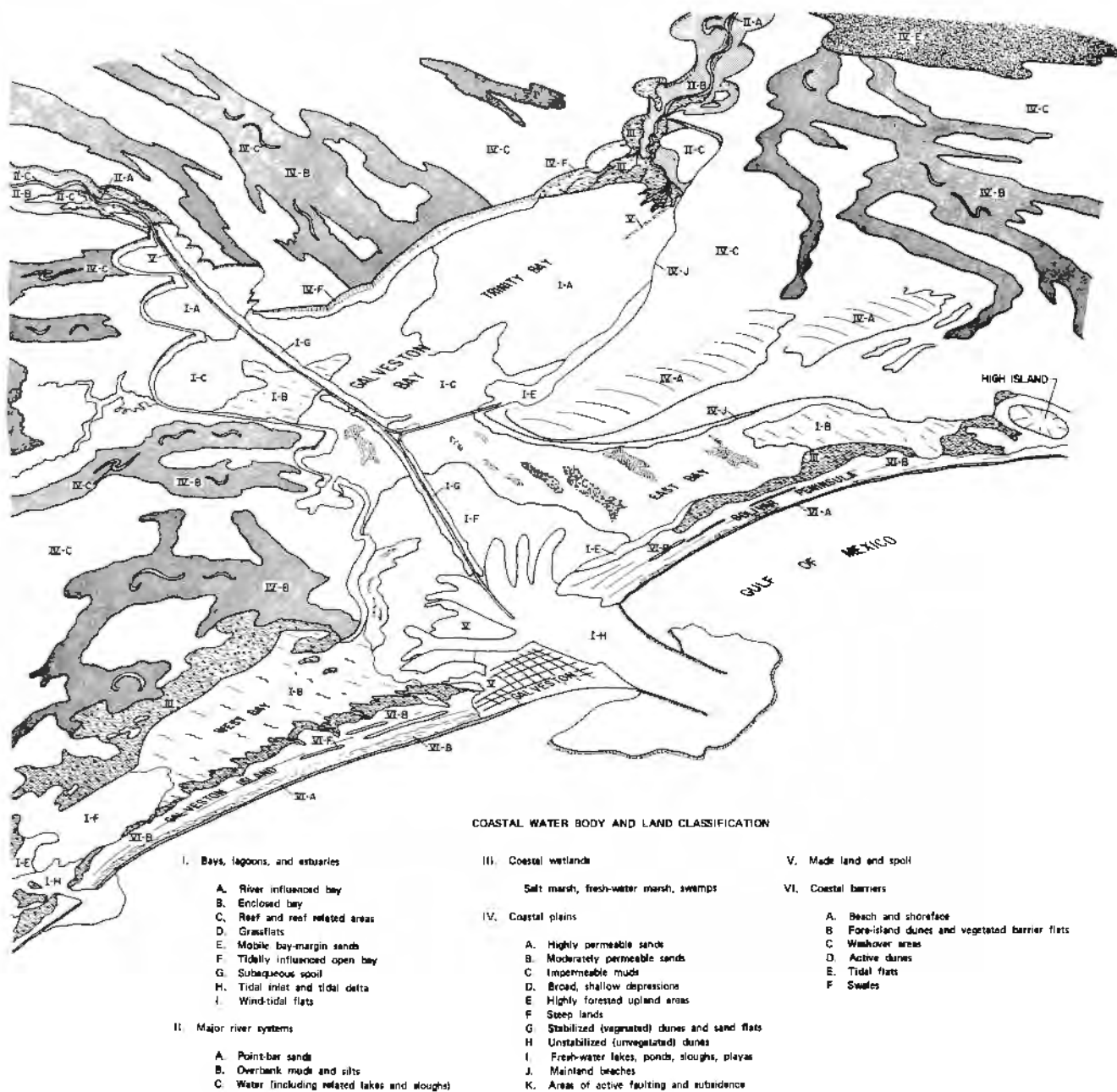
The study is being conducted by C. G. Groat assisted by Stephen Etter and Jeffrey Reid.

MATAGORDA BAY PILOT STUDY

During the fall of 1971, the General Land Office and the Bureau of Economic Geology initiated a cooperative pilot study of Matagorda Bay and environs. One of the major goals of this project is to define coextensive legal and natural boundaries and to determine both natural and man-made changes in these boundaries. Two aspects are being investigated: (1) Delineation of natural shoreline units that mark public and private ownership, including tidal areas and beach zones. Lack of site-monitoring stations precludes adequate boundaries that are coextensive with legal boundaries. (2) Definition of shoreline processes that naturally or through man's alteration result in changes of these coextensive boundaries. Kinds, rates, and causes for change are being determined by sequential mapping on a variety of aerial photographs and coastal charts dating back, respectively, to 1935 and 1856.

The other major goal of the cooperative program is to delineate in detail the presently known types and levels of activities in and around Matagorda Bay, the stresses created by these uses, and the capacity of specific land and water units to sustain these activities. Methodology and results of studies in the Matagorda Bay system can be extended to other bays and estuaries of the Coastal Zone to develop proper and logical land- and water-use management for State-owned coastal lands.

Principal investigators in the project are Lee McKibben and Scooter Cheatham, of The General Land Office, and J. H. McGowen (project coordinator), J. L. Brewton, and R. W. Nordquist, of the Bureau of Economic Geology.



Schematic map of land and water resource capability units, moderately humid upper Texas Coastal Zone.
(From Bureau of Economic Geology Geological Circular No. 71-1, page 6.)

MINERAL RESOURCES OF UNIVERSITY LANDS

During 1971, the Bureau of Economic Geology completed a report on "Mineral Resources of University Lands, Exclusive of Oil and Gas." The project was initiated in the fall of 1969 at the request and with the support of The University's Office of Investments, Trusts, and Lands. The report was prepared by C. G. Groat, P. U. Rodda, L. E. Garner, W. R. Stearns, and L. F. Brown, Jr., of the Bureau staff, with contributions by personnel of University Lands, Geology, Midland.

The report contains an evaluation of mineral resources on lands owned by The University of Texas System. Included in the 106-page report are six geologic maps, four resource maps, and numerous text figures outlining the distribution and occurrence of principal mineral deposits. The report describes the geology of University lands and the occurrence, utilization, production and value, and economic considerations of mineral resources. An appendix lists analyses of rock and mineral deposits from several sampling localities. Mineral resources outlined include industrial carbonates (limestone and dolomite), ground water, sulfur, potash, salt, gypsum, clays, crushed stone, industrial sands, and metals and miscellaneous nonmetals. Principal aim of the project and final report is to inventory the mineral resources of University lands and to outline current or potential development.

TEKTITE RESEARCH CONTINUES

Tektite research carried Dr. Virgil Barnes to Africa and Europe as work continued on his National Science Foundation-supported project. During May and June he visited the Libyan Desert in northern Africa, the only major area of tektite occurrence that he had not previously seen. While travelling in the desert, his party discovered the wreckage of a missing airliner and the remains of the passengers and crew.

In August Dr. Barnes participated in the annual meeting of the Meteoritical Society in Tübingen, Germany where he presented a paper on "Description and Origin of 12.8-kg. Layered Tektite from Thailand" and a talk on "Libyan Desert Glass Occurrence and the Oasis Circular Structure." He then joined field trips to the Stenheim and Ries impact features in southern Germany and to the moldavite-strewn field in southern Bohemia.

BUREAU PRESENTS DELTA COLLOQUIUM

The Bureau of Economic Geology Research Colloquium on "Delta Systems in the Exploration for Oil and Gas," presented originally at Austin in August 1969, was repeated by invitation during 1971 to the New Orleans Geological Society and the Lafayette Geological Society. During 1970, the colloquium was presented by invitation in Midland, sponsored by the Permian Basin Graduate Center, and to the Shreveport Geological Society.

Principal presentations in the colloquium include lectures on deltaic and associated fluvial and barrier-bar processes and case studies emphasizing results of Bureau research on ancient clastic sediments in the Texas Gulf Coast Basin and in the Eastern Shelf of North Texas. Colloquium lecturers include W. L. Fisher, L. F. Brown, Jr., and J. H. McGowen, of the Bureau staff, and A. J. Scott, of the Department of Geological Sciences, The University of Texas at Austin.

A syllabus prepared by the colloquium leaders for the original presentation and published by the Bureau of Economic Geology is now in its fourth printing, with total sales to date nearing 3,000 copies.

Second in the Bureau Research Colloquium Series, scheduled for 1972, is "Clastic Depositional Systems—A Genetic Approach to Stratigraphy, Sedimentation, and Mineral Exploration."

BROWN NAMED AAPG DISTINGUISHED LECTURER

Dr. L. F. Brown, Jr., Associate Director (Research) of the Bureau and Professor of Geological Sciences at The University of Texas at Austin, has been named a Distinguished Lecturer by the American Association of Petroleum Geologists. During the spring and fall of 1972, Brown will lecture throughout North America, primarily to geological societies and departments. Titles of Dr. Brown's lectures are "Upper Paleozoic Fluvial-Deltaic, Shelf, and Slope Depositional Systems in a Cratonic Basin, West-Central Texas" and "Environmental Geology and Genetic Mapping," both based on his Bureau research projects that have received both national and international recognition.

FISHER COMPLETES AAPG DISTINGUISHED LECTURE TOUR

During the spring of 1971, Dr. W. L. Fisher, Director of the Bureau and Professor of Geological Sciences, completed an extensive lecture tour for the American Association of Petroleum Geologists. In the fall of 1970 and the spring of 1971, Fisher addressed forty major geological societies and departments throughout North America on "Ancient Delta Systems of the Gulf of Mexico Basin and Their Relation to Mineral Exploration." His lecture was based on the results of several Bureau research projects he conducted on important mineral-bearing deposits of the Texas Gulf Coast Basin.

PROCTOR RECEIVES BEST PAPER AWARD

At the 1971 meeting in New Orleans of the Gulf Coast Association of Geological Societies and the Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists, Cleo V. Proctor, Jr., research scientist on the Bureau staff, received a Best Paper Award for a presentation he made at the 1970 meeting. The title of Proctor's award-winning paper is "Depositional Systems in the Jackson Group of Texas—Their Relationship to Oil, Gas, and Uranium." The paper, co-authored by W. L. Fisher, Bureau Director, and W. E. Galloway and J. S. Nagle, two geologists formerly with the Bureau, was published in the *Transactions of the Gulf Coast Association of Geological Societies* and is currently in its second printing as Bureau of Economic Geology Geological Circular 70-4. It is one of several recent Bureau reports delineating the main depositional facies of important Gulf Basin geologic units containing significant oil, gas, and hard-mineral deposits.

AAPG CONTINUING-EDUCATION PROGRAM

In 1971, Dr. W. L. Fisher, Director of the Bureau of Economic Geology, was named a participant in the American Association of Petroleum Geologists' Continuing-Education Program. Within this program, a series of twelve one-hour lectures is presented to interested professional groups. Fisher's presentation is titled "Terrigenous Depositional

Systems—A Genetic Approach to Facies Analyses and Mineral Exploration" and is based on several years of Bureau research. His first presentation in this AAPG program was in Rio de Janeiro, Brazil, during July, where a series of lectures was made to the State-owned oil company Petroleo Brasileiro S. A.

WELL SAMPLE AND CORE LIBRARY

Samples and cores from wells drilled in all 254 Texas counties are available for study by any interested persons at the Bureau's Well Sample and Core Library located at The University's Balcones Research Center. Derived primarily from wells drilled for oil and gas, but also from water and engineering test wells, the samples and cores have been donated by various companies and government agencies. The materials provide basic information on Texas subsurface geology and are useful in exploration for oil and gas, sulfur, uranium, and other mineral deposits. The cores and cuttings also provide basic lithologic control for waste-disposal and engineering studies.

The Library's collection was considerably expanded during 1971 by several significant contributions: (1) Amerada Division of Amerada Hess Corporation donated cuttings from 5,400 wells drilled in the Gulf Coast area and also contributed steel shelving for storage; (2) Amoco Production Company furnished 24 cores from wells in East Texas and a sulfur core from High Island, Galveston County; (3) Atlantic Richfield Company donated 7,830 boxes of samples from wells drilled in the East Texas area; (4) Chevron Oil Company presented several hundred feet of cores from the North Texas and Panhandle areas; (5) Cities Service Minerals Corporation donated sulfur test cores from Culbertson County; (6) Jefferson Lake Sulphur Company donated chip cores from 10 sulfur tests in Culbertson County; (7) Piper Petroleum Company presented cores and cuttings from 40 sulfur test wells in the north Fort Stockton area of Pecos County; (8) the United States Bureau of Reclamation furnished 337 boxes of cores from 9 sites where shallow holes were drilled to investigate the subsurface rocks for the proposed Texas Water Plan; and (9) the United States Corps of Engineers gave 29 boxes of core from their exploration boring—located near Selma, between Austin and San Antonio—which penetrated a full section of the Edwards Formation.

After thirteen years of service at the Well Sample Library, Mr. John O. Robinson, Sr., retired on January 15, 1971. Mr. Harry J. Madsen was employed to replace Mr. Robinson. Other personnel

are Mr. Marce L. Morrow, Administrative Clerk-in-Charge, and Mr. Leonard Joyner. The Library is open for use by the public from 8:00 a.m. until 5:00 p.m., Monday through Friday.

MINERAL STUDIES LABORATORY

The Mineral Studies Laboratory, located at Balcones Research Center at the northern edge of Austin, is one of the auxiliary facilities of the Bureau of Economic Geology. Mr. D. A. Schofield is Chemist-in-Charge; other staff members are Mr. Jim Tom Etheredge, Chemist, and Mr. Martin R. Wuensche, Laboratory Assistant.

A prime function of the Mineral Studies Laboratory is to perform chemical analysis, spectrographic analysis, and physical testing of rock and mineral samples in support of many of the research projects of the Bureau of Economic Geology. Most of the samples analysed and tested in 1971 were for the Bureau's regional geologic and geochemical study of Trans-Pecos Texas. The samples comprised soils, rocks, spring sediments, and spring waters. Some were analysed to determine the presence of mercury; others, to determine the presence of trace elements. The Laboratory also analysed, for possible gold content, additional samples that were collected during the Bureau's earlier study of the Van Horn area.

Another important function of the Mineral Studies Laboratory is to provide services for Texas residents, departments of The University of Texas at Austin, and agencies of the State and Federal governments. During 1971, the Laboratory:

(1) provided equipment for preparation of samples by The University's Department of Geological Sciences, (2) made a sample determination for the Department of Petroleum Engineering, and (3) performed a complete chemical analysis of rock for the Texas Parks and Wildlife Department. Consultations were held with industry personnel, private citizens, and staff members of the Texas Highway Department, the United States Bureau of Mines, and The University's Department of Physics.

Texas residents submitted a wide variety of rocks and minerals—including limestone, talc, sulfide minerals, lignite, and other materials—to the Laboratory for analysis. Requests for analyses ranged from spectrographic qualitative analysis (to determine the presence of from one to 49 elements in a sample) to complete chemical analysis of samples.

New equipment received and put into operation at the Mineral Studies Laboratory during the year include a Jarrell-Ash 70-310 Mark IV convertible Ebert stigmatic 3.4-meter spectrograph. A specialist from the Jarrell-Ash Company aligned the optics of the instrument at the Mineral Studies Laboratory. A 9010 arc-spark excitation stand, manufactured by Spex Industries, Inc., was purchased for use in conjunction with the new spectrograph. Since its installation, the spectrograph has been virtually in



Chemists D. A. Schofield and J. T. Etheredge processing sample in newly acquired spectrograph at Mineral Studies Laboratory

constant daily use to analyse samples and also to test methods and techniques that will permit its maximum utilization. The high resolution attainable with this instrument has increased the certainty

of qualitative analysis and the precision of semi-quantitative and quantitative analysis at the Laboratory.

PUBLIC SERVICE

The Bureau of Economic Geology continues to provide numerous services to the public. One such service is to disseminate information about mineral resources, environmental geology, and other aspects of the geology of Texas to individuals, companies, and governmental agencies. Much of the geologic data developed through Bureau research projects is available as published maps and reports. In addition, the Bureau serves as a public inquiries office. Each year the Bureau responds to individual requests for information, received both by letter and telephone and from visitors. During 1971, many members of the Bureau staff provided such direct assistance—by conference and by correspondence—to geologists, engineers, students, tourists, realtors, industrialists, prospectors, rock and mineral collectors, and others. Staff members who spend a large part of their time in such public service are L. E. Garner, who examines rock and mineral specimens submitted to the Bureau for identification, and Roselle Girard, who replies to hundreds of requests for information about Texas geology and mineral resources.

Other public services of the Bureau include preliminary testing and evaluation of selected industrial

rocks and minerals at the Mineral Studies Laboratory under the supervision of D. A. Schofield, Chemist-in-Charge. Also, the Bureau's Well Sample and Core Library continues to provide facilities for geologists and others to examine and study subsurface materials from Texas wells.

Several members of the Bureau research staff, including L. F. Brown, Jr., W. L. Fisher, and R. L. Shipman, presented information about the environmental geology of the Texas Gulf Coast at group meetings and at hearings during 1971. Additional individual public services rendered during the year are described elsewhere in this Report under "Other Professional Activities."

The Bureau provides a public Reading Room that contains publications pertaining to Texas geology and natural resources. Located on the fifth floor of the Geology Building on the Main Campus of The University of Texas at Austin, the Reading Room is open to the public Monday through Friday from 8:00 a.m. to 5:00 p.m. In addition, work maps, sections, and data developed in on-going research projects are available for examination at the Bureau's main office.

STAFF ACTIVITIES

Meetings Attended

Staff members represented the Bureau of Economic Geology at numerous scientific and professional meetings in 1971. Principal meetings attended during the year include:

American Association for the Advancement of Science, Annual Meeting, Philadelphia, Pennsylvania—L. F. Brown, Jr.

American Association of Petroleum Geologists, Annual Meeting, Houston, Texas—V. E. Barnes, L. F. Brown, Jr., G. K. Eifler, Jr., A. W. Erxleben, W. L. Fisher, C. G. Groat, R. S. Kier, J. W.

Macon, J. H. McGowen, C. V. Proctor, Jr., R. L. Shipman, W. R. Stearns

American Association of Petroleum Geologists, Southwest Section, Annual Meeting, Abilene, Texas—L. F. Brown, Jr., W. L. Fisher, J. W. Macon, J. H. McGowen

American Commission on Stratigraphic Nomenclature, Meeting, Washington, D. C.—V. E. Barnes

Apollo 12 Lunar Science Conference, National Aeronautics and Space Administration, Houston, Texas—V. E. Barnes

Association of American State Geologists, Annual Meeting, Kennebunkport, Maine—W. L. Fisher, R. L. Shipman; Fall Meeting, Washington, D. C.—W. L. Fisher and L. F. Brown, Jr.

Coastal & Shallow Water Research Conference, Louisiana State University, Baton Rouge, Louisiana—W. L. Fisher

Conference on Trace Substances in Environmental Health, 5th Annual, Columbia, Missouri—C. G. Groat

Forum on Geology of Industrial Minerals, 7th Annual, Tampa, Florida—C. G. Groat

Governor's 6th Regional Planning Workshop, San Antonio, Texas—W. L. Fisher, R. L. Shipman

Geological Society of America, Annual Meeting, Washington, D. C.—V. E. Barnes, L. F. Brown, Jr., W. L. Fisher, C. G. Groat, R. L. Shipman

Gulf Coast Association of Geological Societies, Annual Meeting, New Orleans, Louisiana—J. W. Macon, C. V. Proctor, Jr.

Hurricane Effects Conference, "Minimization of Hurricane-Produced Losses Through Improvement in Building Policies," sponsored by the Bureau of Engineering Research of The University of Texas at Austin, Winedale Inn, Roundtop, Texas—C. G. Groat

International Sedimentological Congress, VIII, Heidelberg, Germany—V. E. Barnes

Meteoritical Society, Annual Meeting, Tübingen, Germany—V. E. Barnes

Soil Survey Technical Work-Planning Conference, Texas A&M University, College Station, Texas—L. E. Garner

Symposium on the Geology of Western Mexico, October Meeting and Field Trip sponsored by Instituto de Geologia, Universidad de Mexico and Department of Geological Sciences, The University of Texas at Austin, Mexico, D. F., Mexico—C. G. Groat

Texas Advisory Committee on Conservation Education, Austin, Texas—W. L. Fisher

Texas Mapping Advisory Committee, September Meeting, Austin, Texas—G. K. Eifler, Jr., W. L. Fisher

Underground Waste Management & Environmental Implications, Meetings sponsored by United States Geological Survey and American Association of Petroleum Geologists, Houston, Texas—W. L. Fisher, R. L. Shipman

Lectures and Public Addresses

V. E. Barnes—

Description and origin of 12.8-kg. layered tektite from Thailand: Meteoritical Society, Annual Meeting, Tübingen, Germany

Libyan desert glass occurrence and oasis circular structure: Austin Geological Society, Austin, Texas; *and* Meteoritical Society, Annual Meeting, Tübingen, Germany; *and* Shreveport Geological Society, in connection with field trip, Burnet, Texas

L. F. Brown, Jr.—

An approach to environmental geology with examples from the Texas Coastal Zone: American Geological Institute Short Course on Environmental Geology, held in conjunction with the American Association of Petroleum Geologists Annual Meeting, Houston, Texas

Coastal environmental geology: Graduate Class in Architecture, The University of Texas at Austin, Austin, Texas; *and* tape recording prepared for radio presentation by The University of Texas News and Information Service, Austin, Texas

Environmental geology of the Texas Gulf Coast: Austin Kiwanis Club, Austin, Texas; *and* Engineering Geology Class, The University of Texas at Austin, Austin, Texas

Fluvial and deltaic depositional systems of the Eastern Shelf of North and West-central Texas: American Association of Petroleum Geologists, Southwest Section, Annual Meeting, Abilene, Texas

Geologic evaluation of sanitary land-fill sites, Texas Coastal Zone: Symposium on Geologic Implications of Solid-Waste Land Fill, American Association for the Advancement of Science, Annual Meeting, Philadelphia, Pennsylvania

Recognition of fluvial and deltaic sandstones of Pennsylvanian and Permian age in North-central Texas: American Association of Petroleum Geologists, Annual Meeting, Houston, Texas

W. L. Fisher—

Activities of the Bureau of Economic Geology: The University of Texas at El Paso, Geology Technical Session, El Paso, Texas

Ancient delta systems of the Gulf of Mexico Basin and their relation to mineral exploration [American Association of Petroleum Geologists Distinguished Lecture]: Alberta Society of Petroleum Geologists, Calgary, Alberta, Canada; *and* Alaska Geological Society, Anchorage, Alaska; *and* Arizona State University, Tempe, Arizona; *and* Corpus Christi Geological Society, Corpus Christi, Texas; *and* Dallas Geological Society, Dallas, Texas; *and* The Edmonton Geological Society, Edmonton, Alberta, Canada; *and* Four Corners Geological Society, Durango, Colorado; *and* The Liberal Geological Society, Inc., Liberal, Kansas; *and* Nebraska Geological Society—University of Nebraska, Lincoln, Nebraska; *and* Oklahoma City Geological Society, Oklahoma City, Oklahoma; *and* Panhandle Geological Society, Amarillo, Texas; *and* Rocky Mountain Association of Geologists, Denver, Colorado; *and* South Texas Geological Society, San Antonio, Texas; *and* Sul Ross State University, Alpine, Texas; *and* University of Alaska, Fairbanks, Alaska; *and* University of Oregon, Eugene, Oregon; *and* University of South Dakota, Vermillion, South Dakota; *and* West Texas Geological Society, Midland, Texas; *and* Wyoming Geological Association, Casper, Wyoming

Environmental geologic mapping, Texas Coastal Zone: Texas Mapping Advisory Committee, Austin, Texas; *and* Texas Water Development Board, Austin, Texas; *and* Interagency Council on Natural Resources and Environment,

Austin, Texas; *and* Alamo Area Council of Governments, San Antonio, Texas; *and* Texas Water Development Board Environmental Advisory Panel, Austin, Texas

Environmental geology and coastal zone management: Coastal & Shallow Water Research Conference, Louisiana State University, Baton Rouge, Louisiana

Geology and the environment: Texas Outdoor Writers Association Seminar, "Environment and the Press," Austin, Texas

Some aspects of environmental education: Texas Advisory Council on Environmental Education, Winedale Inn, Roundtop, Texas

Terrigenous depositional systems—a genetic approach to facies analysis and mineral exploration: American Association of Petroleum Geologists Continuing-Education Program, Rio de Janeiro, Brazil

Tertiary depositional systems of the Gulf of Mexico Basin: American Association of Petroleum Geologists, Southwest Section, Annual Meeting, Abilene, Texas

L. E. Garner—

Mineral resources of Texas: Environmental Education Workshop sponsored by the Texas Education Agency and participating universities and colleges, Sam Houston State University, Huntsville, Texas; *and* Texas Wesleyan College, Fort Worth, Texas

C. G. Groat—

Area natural resources: Industrial Planning Seminars sponsored by the Texas Industrial Commission, Boerne, Texas; *and* Elkhart, Texas; *and* Freer, Texas; *and* Knox City, Texas; *and* Madisonville, Texas

Mineral resources and the environment: McCallum High School Science Club, Meeting, Austin, Texas

Mineral-resource potential of Trans-Pecos Texas: Pecos Chamber of Commerce, Meeting, Pecos, Texas

Texas mineral resources—economic and environmental considerations: Environmental Education Workshop sponsored by the Texas Education Agency and participating universities, East Texas State University, Commerce, Texas; and The University of Texas at El Paso, El Paso, Texas

J. H. McGowen—

Alluvial fans and fan deltas—depositional models of some terrigenous clastic wedges: American Association of Petroleum Geologists, Southwest Section, Annual Meeting, Abilene, Texas; and North Texas Geological Society, Meeting, Wichita Falls, Texas

Environmental Geologic Atlas of the Texas Coastal Zone: Society of Economic Paleontologists and Mineralogists, Eastern Section, Meeting, Port Aransas, Texas

R. L. Shipman—

Environmental Geologic Atlas of the Texas Coastal Zone: Houston-Galveston Council of Governments, Meeting, Houston, Texas; and Texas Water Quality Board, Galveston Bay Project Meeting, Houston, Texas

Geopolitics: Sigma Gamma Epsilon, Annual Dinner Meeting, Austin, Texas

E. G. Wermund, Jr.—

Remote Sensing in the Oil Business: Permian Basin Section of the Society of Economic Paleontologists and Mineralogists, Meeting, Midland, Texas

Committee Service and Offices

V. E. Barnes—

American Commission on Stratigraphic Nomenclature: Member representing Association of American State Geologists at meeting held in Washington, D. C., in connection with Geological Society of America Annual Meeting

Austin Geological Society: Vice-President, 1970-1971; Executive Committee, 1970-1971; Delegate to House of Delegates, American Association of Petroleum Geologists (represented Society at Houston Meeting, 1971)

G. K. Eifler, Jr.—

Austin Geological Society: Technical Program Committee, 1971-1972

W. L. Fisher—

Association of American State Geologists: Environmental Geology Committee

Texas Advisory Committee on Conservation Education

Texas Mapping Advisory Committee

The University of Texas at Austin: Committee on Publications, Chairman; Geology Foundation, Executive Committee; *Ad hoc* Committee on Review and Approval Procedures for Sponsored Projects

R. M. Girard—

Austin Geological Society: Publications Committee, 1971-1972

Other Professional Responsibilities

V. E. Barnes—

Co-chairman of Session on Geochemistry, Mineralogy, and Source Rocks: Society of Economic Mineralogists and Paleontologists, Annual Meeting, Houston, Texas

Co-leader, Field trip to Llano Uplift of Central Texas: Shreveport Geological Society, Shreveport, Louisiana, Fall Field Excursion to Central Texas

Leader, Field trip through Pedernales Falls State Park, Blanco County, Texas: Sierra Club of Austin, Field Excursion

L. F. Brown, Jr.—

As an American Geological Institute Visiting Geoscientist, presented talks on coastal environmental geology, the role of compaction and tectonics in controlling fluvial and deltaic depositional sites, and depositional systems on the eastern margin of the West Texas Basin: Louisiana Technological University, Ruston, Louisiana; and Northeast Louisiana State University, Monroe, Louisiana

Presented an informal discussion of north-central Texas delta systems to "Toasting Timely Topics" group: American Association of Petroleum Geologists, Annual Meeting, Houston, Texas

Presented testimony on March 31 at hearings held by United States Corps of Engineers at Port Lavaca, Texas, concerning shell-dredging permit (published as "A Statement Presented at Public Hearings Concerning the Application of Lone Star Cement Corporation for Dredging Shell for Commercial Purposes in Matagorda Bay": Excerpts from Testimony, U. S. Corps of Engineers Public Hearing, Port Lavaca, Texas, March 31, 1971, Texas Senate, Austin, Texas, pp. 25-29).

G. K. Eifler, Jr.—

Conferred in the field with Zane Speigel, of New Mexico Bureau of Mines, and Warren Finch, of United States Geological Survey, for discussion on Triassic stratigraphy in the Canadian River valley of New Mexico and Texas

W. L. Fisher—

Host of "Toasting Timely Topics" group to discuss "Ancient and Modern Clastics":

American Association of Petroleum Geologists, Annual Meeting, Houston, Texas

Interviewee on two radio programs of the "Texas Business Review" series; topics were "Ancient Depositional Systems and Their Relationship to Mineral Deposits" and "Texas Mineral Resources and Industry": The University of Texas at Austin, Bureau of Business Research in cooperation with Communication Center, Austin, Texas

Moderator, Solid Waste/Air Quality Management Session: Governor's Sixth Annual Inter-Governmental Relations and Regional Planning Workshop, San Antonio, Texas

Panelist on radio program of the "Insight: Campus '71" series; topic discussed was "Man and Mineral Resources": The University of Texas at Austin, Communication Center in cooperation with News and Information Service, Austin, Texas

W. L. Fisher and L. F. Brown, Jr.—

Presentation of the Bureau of Economic Geology Coastal Environmental Program: Alamo Council of Governments, September Meeting, San Antonio, Texas; and Texas Water Development Board, Austin, Texas; and U. S. Geological Survey, Denver, Colorado; and also 15 specific presentations to various civic, State, and foreign visitors.

Presented a Continuing-Education Short Course, "Deltas in the Exploration for Oil, Gas, and Other Minerals": Shreveport Geological Society, Shreveport, Louisiana

Presented testimony on January 23 at Texas Water Development Board Coastal Environment Hearings, Port Aransas, Texas

Submitted a report, "Environmental Geology of the Texas Coastal Zone—An Inventory of Resources and Uses," that was published, in part, on pages 18-19 of Pollution vs. the People, Joint Report of the Interim Committee on Pipeline Study and Beaches, 62nd Legislature of the State of Texas, 1971

W. L. Fisher, L. F. Brown, Jr., and J. H. McGowen—

Presented a Continuing-Education Short Course, "Deltas in the Exploration for Oil, Gas, and Other Minerals": Lafayette Geological Society, Lafayette, Louisiana; and New Orleans Geological Society, New Orleans, Louisiana

W. L. Fisher, A. W. Erxleben, L. F. Brown, Jr., and J. H. McGowen—

Participated in Bay and Estuary Management Study sponsored by Division of Planning Coordination, Austin, Texas, during summer 1971

C. G. Groat—

Panel member for interview of Austin City Council candidates concerning environmental

issues: sponsored by Austin Environmental Council and radio station KTAP

J. H. McGowen and C. G. Groat—

Co-leaders, field trip to examine facies of the Van Horn alluvial fan system, an Early Paleozoic terrigenous clastic body: Sigma Gamma Epsilon, The University of Texas at Austin; Field Excursion to the Van Horn Area of Culberson and Hudspeth Counties, Texas

R. L. Shipman—

As a representative of the Bureau of Economic Geology, attended hearings held by United States Corps of Engineers at Port Lavaca, Texas, concerning shell-dredging in Matagorda Bay

Teaching Duties of the Bureau Staff

Several members of the Bureau staff hold joint appointments with the Department of Geological Sciences at The University of Texas at Austin. Some supervise graduate student theses and dissertations and several serve on graduate student committees. Two Bureau staff members, L. F. Brown, Jr., and W. L. Fisher, along with A. J. Scott of the Department, teach a regularly scheduled course, Geology 383, "Terrigenous Depositional Systems."

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