

Henderson

Smith

The University of Texas



Rusk

BUREAU OF ECONOMIC GEOLOGY

Explanation of Symbols



IRON ORE



LIGNITE



BLAST
FURNACE



100'
CONTOURS



RAIL-ROADS



COUNTY
ROADS



RIVERS AND
STREAMS

Map of Cherokee County Texas

0 1 2 3 4 5 6 7 8 9 10 miles

University of Texas

Bureau of Economic Geology and Technology

W. B. Phillips Ph.D.

Director

REPORT FOR 1965

Angelina

BUREAU OF ECONOMIC GEOLOGY

Applied to Resource and
Engineering Problems

Basic Research

RESEARCH AND SERVICE IN GEOLOGY

Systematic Geologic
Mapping

Well Sample and
Core Library

Mineral Statistics and
Mineral Information

Mineral Studies
Laboratory

Cover: An early mineral resource map of Cherokee County, Texas,
compiled by the then Bureau of Economic Geology and Technology
about 1910 under the Directorship of Dr. William Battle Phillips.

THE BUREAU OF ECONOMIC GEOLOGY is one of the organized research bureaus of The University of Texas. Established in 1909, it has for 56 years carried out the function of a State Geological Survey; its Director fills the position of State Geologist. The Bureau is engaged in a four-point program of research and public service in earth science and Texas mineral resources as follows: (1) basic geological research, (2) geology applied to resource and engineering problems, (3) systematic geologic mapping, and (4) public-service mineral information, identification and testing, and compilation of mineral statistics. The Bureau participates in other University research efforts in the fields of resources and earth sciences, such as the Center for Research in Water Resources. As a part of its effort, the Bureau publishes major reports in The University of Texas Publication series; it also has its own series of Reports of Investigations, Geologic Quadrangle Maps, Guidebooks, Geological Circulars, and Mineral Resource Circulars. The Guidebooks include non-technical publications of general interest.

The basic 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. These include the Texas Water Development Board, Railroad Commission of Texas, Parks and Wildlife Department, Texas Highway Department, Texas Industrial Commission, and numerous other State boards, conservation organizations, water districts, and Chambers of Commerce. The Bureau also cooperates formally and informally 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 and private groups, corporations, and citizens through correspondence and conference.

As a result of growing interest in outdoor recreation, nature study, and tourism, the Bureau has attempted to tell the geologic story of Texas through a series of popular guidebooks. Two general guides—*Texas Fossils* and *Texas Rocks and Minerals*, published in 1960 and 1964, are "best sellers" and are used as source material by elementary and secondary school teachers. The *Geologic Story of Longhorn Cavern* was told in a guidebook published in 1963. Other such guidebooks are being prepared.

The Bureau has offices on the Little Campus as well as a Mineral Studies Laboratory and Well Sample and Core Library at the Balcones Research Center.

Publications in 1965

Report of Investigations No. 54. **ROCK AND MINERAL RESOURCES OF EAST TEXAS**, by W. L. Fisher, With Contributions by C. R. Chelf, C. A. Shelby, L. E. Garner, D. E. Owen, and D. A. Schofield. 439 pp. 71 figs., 6 pls., 49 tables, August 1965 \$4.00

Mineral resources of a 33,000-square-mile area of eastern and northeastern Texas are the subject of a recently completed 30-month study conducted by the Bureau of Economic Geology and published as Report of Investigations No. 54. The investigation was supported in part by a \$40,000 contract with the Area Redevelopment Administration, U. S. Department of Commerce. The report was prepared by Dr. W. L. Fisher, Bureau Research Scientist, with contributions by C. R. Chelf, C. A. Shelby, L. E. Garner, D. E. Owen, and D. A. Schofield. It treats the occurrence, distribution, geology, reserves, quality, production, mining and processing, current and potential utilization, and production costs of principal East Texas mineral commodities. Main economic considerations in development are outlined. Counties included in the report are: Anderson, Angelina, Bowie, Camp, Cass, Cherokee, Delta, Franklin, Freestone, Gregg, Harrison, Henderson, Hopkins, Houston, Jasper, Lamar, Leon, Limestone, Madison, Marion, Montgomery, Morris, Nacogdoches, Newton, Panola, Polk, Rains, Red River, Robertson, Rusk, Sabine, San Augustine, San Jacinto, Shelby, Smith, Titus, Trinity, Tyler, Upshur, Van Zandt, Walker, and Wood (see pp. 16-18).

Report of Investigations No. 55. **HEAVY MINERALS IN THE WELLBORN FORMATION, LEE AND BURLESON COUNTIES, TEXAS**, by Cader A. Shelby. 54 pp., 5 figs., 11 pls., April 1965 \$1.25

The Wellborn Formation, composed of sediments deposited in near-shore environments, is characterized by cross-bedded sandstone lentils interbedded with montmorillonite, lignitic shale, and lignite. At five places along the outcrop of the formation in Lee and Burleson counties, anomalously high gamma radiation is associated with concentrations of heavy minerals, the most abundant of which are ilmenite, magnetite, and zircon.

A geologic and radiation map of parts of Flag Pond and Somerville quadrangles and a correlation diagram of the Wellborn Formation in Lee and Burleson counties accompany this publication. Photographs of various features, e.g., cross-bedding, plant drag marks, wave ripple marks, and joints, are included also. Table 3 consists of grain counts of heavy mineral concentrates from selected samples. An appendix contains a locality register and petrographic descriptions of thin and polished sections as well as description of 18 measured sections.

OIL AND WATER—RELATED RESOURCE PROBLEMS OF THE SOUTHWEST. A Symposium, edited by Peter T. Flawn. 64 pp., 8 figs., June 1965 50 cents

Texts of eight papers presented at the January 29, 1965 meeting of the Southwestern Federation of Geological Societies, held in Austin and sponsored by The University of Texas. Con-

tents include:

Resources and the State Government, by Judge Jim C. Langdon, Commissioner, Railroad Commission of Texas, Austin, Texas

Oil and Gas Versus Water in the Southwest: Conflict or Compromise?, by Richard E. Faggioli, Humble Oil & Refining Co., Corpus Christi, Texas

The Texas Railroad Commission Looks Ahead, by George F. Singletary, Administrative Engineer, Texas Railroad Commission, Austin, Texas

What Exploration Geologists Should Know About Pollution, by Earnest F. Gloyna, Professor of Civil Engineering; Director, Environmental Health Engineering Laboratories; Director, Center for Research in Water Resources, The University of Texas, Austin, Texas

Pollution Control: The Relation of Water Quality Protection to Exploration for and Protection of Oil and Gas in the Southwest, by John J. Vandertulip, Chief Engineer, The Texas Water Commission, Austin, Texas

Ground Water for the Oil Industry in Texas and Southeast New Mexico, by William F. Guyton, Consulting Ground-Water Hydrologist, Austin, Texas

Economic and Social Implications of Water and Oil Resources, by Stanley A. Arbingast, Professor of Resources; Associate Director, Bureau of Business Research, The University of Texas, Austin, Texas

Oil, Gas, and Water Law—Today and Tomorrow, by J. Chrys Dougherty; Graves, Dougherty, Gee and Hearon, Austin, Texas

Geological Circular 65-1. **BLOATING CHARACTERISTICS OF EAST TEXAS CLAYS**, by W. L. Fisher and L. E. Garner. 20 pp., 12 figs., March 1965 50 cents

This paper discusses bloating incidence among approximately 600 clay samples from an area of about 35,000 square miles in East and Northeast Texas. Clays that bloat or expand upon firing have been used in the manufacture of lightweight aggregate, and in recent years, lightweight clay aggregate has been used increasingly in both load-bearing and non-load-bearing concrete castings and forms. Texas annually produces about 0.8 million tons of lightweight clay aggregate. The purpose of this study was to correlate bloating incidence with certain physical and mineralogical properties of a wide variety of clays and to utilize this correlation as a simple tool in the exploration of clays suitable for manufacture of lightweight aggregate.

Geological Circular 65-2. **TEXAS MINERAL RESOURCES: PROBLEMS AND PREDICTIONS**, by Peter T. Flawn. 17 pp., 1 fig., April 1965 50 cents

This paper, the text of an address to the Governor's Conference on Natural Resource Management and Development in Texas, held in Dallas October 1964, is divided into a discussion of the today, the yesterday, and the tomorrow of Texas mineral resources.

Geological Circular 65-3. A REVISION OF TAYLOR NOMENCLATURE: UPPER CRETACEOUS, CENTRAL TEXAS, by Keith Young. 11 pp., 3 figs., May 1965. 50 cents

This circular proposes formal names for two lithic units which have long been used as formations but have remained unnamed—"Lower Taylor Marl" and "Upper Taylor Marl" of R. T. Hill. Sprinkle Formation is proposed for the formation formerly referred to as the "Lower Taylor Marl."

Bergstrom Formation is proposed for the claystone unit, overlying the Pecan Gap Formation, usually referred to as the "Upper Taylor Marl."

Complete description of these two formations is given as well as information on accessible exposures. The figures illustrate the Sprinkle-Big House boundary at the old Manor road crossing of Little Walnut Creek, Travis County; the Sprinkle-Pecan Gap boundary east of Austin at Walnut Hill, Travis County; and the Bergstrom-Corsicana boundary, $\frac{7}{8}$ mile west of Noack in Williamson County.

Geological Circular 65-4. TEXAS MINERALS: TRENDS IN PRODUCTION, by W. L. Fisher. 28 pp., 34 charts, December 1960 50 cents

Annual production of minerals in Texas currently amounts to more than 4.5 billion dollars, and mineral production makes the largest contribution to the State's economy. Analyses of past production trends and economic factors allow predictions of future trends in this segment of the Texas economy. This circular includes production graphs and brief annotations of production trends of principal or representative Texas mineral commodities in the period 1950 through 1964. Sources of data are included in the paper.

Geological Circular 65-5. GEOLOGY IN THE STATE GOVERNMENT OF TEXAS, by P. T. Flawn. 11 pp. December 1965 50 cents

This paper describes the several "geological surveys" which have existed at various times in Texas. These are (1) the First or Shumard Survey; (2) the Second Survey; (3) the Third or Dumble Survey; (4) The University of Texas Mineral Survey; and (5) Bureau of Economic Geology of The University of Texas. In Texas the Bureau of Economic Geology now functions as a geological survey, although it is more a research agency and less a service agency than many State Surveys. In Texas other State agencies have built geological staffs to handle special resource and engineering problems—the Railroad Commission, the Highway Department, Water Development Board, Board for Lease of University Lands, and General Land Office. On many occasions, the Bureau of Economic Geology has served as a consultant to geological staffs in other State agencies. State geological surveys are in a period of profound change—involving change from reconnaissance to detail and from inventory to management. Modern decisions on land-use planning, resources, or conservation require geological counsel.

GEOLOGIC ATLAS OF TEXAS, TYLER SHEET. Scale: 1:250,000. John T. Lonsdale Memorial Edition. March 1965 \$2.50

This map is the first sheet of the Geologic Atlas to be com-

pleted and distributed. Base for this geologic map is the new Army Map Service base on a scale of 1:250,000 (4 miles to the inch) encompassing an area of one-degree latitude by two-degrees longitude. This map shows topography and roads as well as cities, towns, railroads, and other cultural objects.

The geologic map was compiled under direction of Dr. V. E. Barnes, Associate Director of the Bureau, assisted by photo-geologist Mrs. C. A. Pieper and other Bureau staff. A committee of the East Texas Geological Society advised Dr. Barnes. All drafting work was done by the Bureau's cartographic division.

This Tyler Sheet is published in a memorial edition honoring the late Dr. John T. Lonsdale, Director of the Bureau of Economic Geology from 1945 to 1960, under whose direction the project was initially conceived.

Geologic Quadrangle Map No. 27. GEOLOGY OF THE HYE QUADRANGLE, BLANCO, GILLESPIE, AND KENDALL COUNTIES, TEXAS, by V. E. Barnes. Map with 8-page text. Scale: 1:24,000. January 1965 \$1.50

This is the second in a new series of 7½-minute quadrangle maps in Blanco, Gillespie, and adjoining counties compiled on the recently published topographic bases.

Hye quadrangle is high on the southeastern side of the Llano uplift. Cambrian and Ordovician rocks are represented by about one square mile of outcrop; Cretaceous rocks and small Quaternary surficial deposits occupy the remainder. Mineral resources of the quadrangle are limited to construction materials (dimension stone, crushed stone, sand and gravel, and road material) and water. A description of samples from the Nixon-Dore-Power No. 1 Andrew Lindig and a stratigraphic section complete the text.

The LBJ Ranch headquarters are located in the northwest corner of the map area.

Geologic Quadrangle Map No. 29. GEOLOGY OF THE ROCKY CREEK QUADRANGLE, BLANCO AND GILLESPIE COUNTIES, TEXAS, by V. E. Barnes. Map with 12-page text. Scale: 1:24,000. October 1965 \$1.50

This geologic map is another in the series of Central Texas geologic quadrangle maps being issued by the Bureau. The area mapped includes part of the LBJ Ranch, and a log of a well on that ranch is given in the text. Elevations in the Rocky Creek quadrangle range from 1,200 feet in western Blanco County to 1,880 feet in eastern Gillespie County. Mineral resources of the area consist of construction materials and water. Lead and zinc mineralization occurs around a granite dome in Pedernales River, and there is a possibility that subsurface ore bodies are present.

TEXAS MINERAL PRODUCERS (EXCLUSIVE OF OIL AND GAS), compiled by Roselle M. Girard. 91 pp., May 1965 50 cents

Mineral Resource Circular No. 47. THE MINERAL INDUSTRY OF TEXAS IN 1964, by F. F. Netzeband, Harold F. Pierce, and Roselle M. Girard, December 1965 Free on request

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Publications in Press

- Report of Investigations No. 56. Limestone and Dolomite Resources, Lower Cretaceous Rocks, Texas, by P. U. Rodda, W. L. Fisher, and D. A. Schofield.
- Report of Investigations No. 57. Sedimentary Petrology and History of the Haymond Formation (Pennsylvanian), Marathon Basin, Texas, by Earle F. McBride.
- Geologic Quadrangle Map No. 28. Geology of the Presidio Area, Presidio County, Texas, by John W. Dietrich.
- Geologic Quadrangle Map No. 30. Geology of Black Gap Area, Brewster County, Texas, by Bill E. St. John.
- Geologic Quadrangle Map No. 31. Geology of the Stonewall Quadrangle, Gillespie and Kendall Counties, Texas, by V. E. Barnes.
- University of Texas Publication. Geology of Big Bend National Park, Brewster County, Texas, by Ross A. Maxwell, John T. Lonsdale, Roy T. Hazzard, and John A. Wilson.
- Geologic Atlas of Texas, Texarkana Sheet, scale 1:125,000. V. E. Barnes, Project Director. E. H. Sellards Memorial Edition.

Publications by Bureau of Economic Geology Staff in Scientific Journals

- Barnes, V. E., with R. V. Russell (1965) Devitrification of glass around bubbles in tektites (abst.): Trans. Amer. Geophys. Union, Fifth Western National Meeting, vol. 46, no. 3, p. 545.
- Barnes, V. E. (1965) Original tektite crust (abst.): XXth Internat. Congress of Pure and Applied Chemistry, Division C: Cosmic Chemistry, Moscow, p. 20.
- Barnes, V. E. (1965) Tektites, in *Encyclopaedia Britannica* (article revised).
- Barnes, V. E., with C. E. Hedge and Z. E. Peterman (1965) Soil: source material for tektites (abst.): Trans. Amer. Geophys. Union, Fifth Western National Meeting, vol. 46, no. 3, p. 545.
- Fisher, W. L. (1965) Mineral resources and mineral industries of East Texas: Texas Business Review, vol. 39, pp. 126-130.
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- Fisher, W. L. (1965) The search for nonfuel minerals: South Texas Geol. Soc. Bull., vol. 5, no. 2, pp. 6-12.
- Flawn, P. T. (1965) Actualización de la geología: Geología y Metalurgia, Universidad Autonoma Potosina, San Luis Potosi, tomo 11, numero 11, pp. 44-48.
- Flawn, P. T. (1965) Basement: not the bottom but the beginning: Bull. Amer. Assoc. Petroleum Geologists, vol. 49, pp. 883-886.
- Flawn, P. T. (1965) Geology and urban development: Town and City, Vol. XII, no. 7, pp. 9-10, 20.
- Flawn, P. T. (1965) Minerals: final harvest or endless crop?: Engineering and Mining Jour., vol. 166, no. 5, pp. 106-108.
- Flawn, P. T. (1965) Mineral resources: cost concept versus orebody concept: Geotimes, vol. 9, no. 5, pp. 17-18.
- Flawn, P. T. (1965) Texas mineral resources: problems and predictions: Proc., Governor's Conference on Resource Management and Development, pp. 73-86.
- Flawn, P. T. (1965) Texas rocks on paper: Texas Quarterly, Vol. VIII, no. 1, pp. 97-101.
- Flawn, P. T. (1965) The State and industrial minerals: 65th Ann. Rept. of the Mining Industry of Idaho for 1963-64, pp. 14-17.
- Flawn, P. T. (1965) Who took the "economic" out of economic geology?: Econ. Geol., vol. 60, no. 1, pp. 172-175.
- Garner, L. E., with W. L. Fisher (1965) Bloating characteristics of East Texas clays (abst.): Geol. Soc. America Special Paper 82, p. 62.

Girard, R. M., with F. F. Netzeband and H. F. Pierce (1965) The mineral industry of Texas in 1964: U. S. Bureau of Mines Minerals Yearbook 1964, Vol. III (preprint, 47 pp.).

Maxwell, R. A., with J. W. Dietrich (1965) Geologic summary of the Big Bend region, *in* Geology of the Big Bend area, Texas: West Texas Geol. Soc. Pub. 65-51, pp. 11-33.

Maxwell, R. A., with J. W. Dietrich and West Texas Geological Society 1965 Field Trip Road Log Committee (1965) Road logs, *in* Geology of the Big Bend area, Texas: West Texas Geol. Soc. Pub. 65-51, pp. 43-167.

Rodda, P. U. (1965) Augusta H. Kemp collection presented to The University of Texas: Jour. Paleontology, vol. 39, p. 168.

Projects

Texas Geologic Atlas

The fourth year of the Texas Geologic Atlas Project was completed during 1965. The Tyler sheet was published in March and the Texarkana sheet is scheduled for publication early in 1966. Preliminary copy of the Texarkana sheet was reviewed by the Geologic Atlas Project Committee of the East Texas Geological Society during the period from May through August.

Field checking and mapping have been completed for the Palestine-Alexandria, Lubbock, Van Horn-El Paso, Houston-Port Arthur sheets and nearly completed for the Beaumont-Lake Charles sheet. Scribing has been completed on the Palestine-Alexandria, Van Horn-El Paso, and Houston-Port Arthur sheets and is in progress on the Sherman, Beaumont-Lake Charles, and Lubbock sheets. Copy for these sheets will be prepared for review by the Geologic Atlas Project Committee of the various geological societies concerned. It is hoped that all of these sheets will be published during the coming year.

Field checking is in a preliminary stage on the Dallas, Waco, and Plainview sheets.

Contributions of geologic mapping, although not as numerous as in former years, continue to be received. As revisions of the Army Map Service 1:250,000 sheets are made, revised base materials are obtained by the Bureau. Revised base material has been received for the Tucumcari, Lake Charles, Bay City, Fort Stockton, Llano, El Paso, San Antonio, and Van Horn sheets.

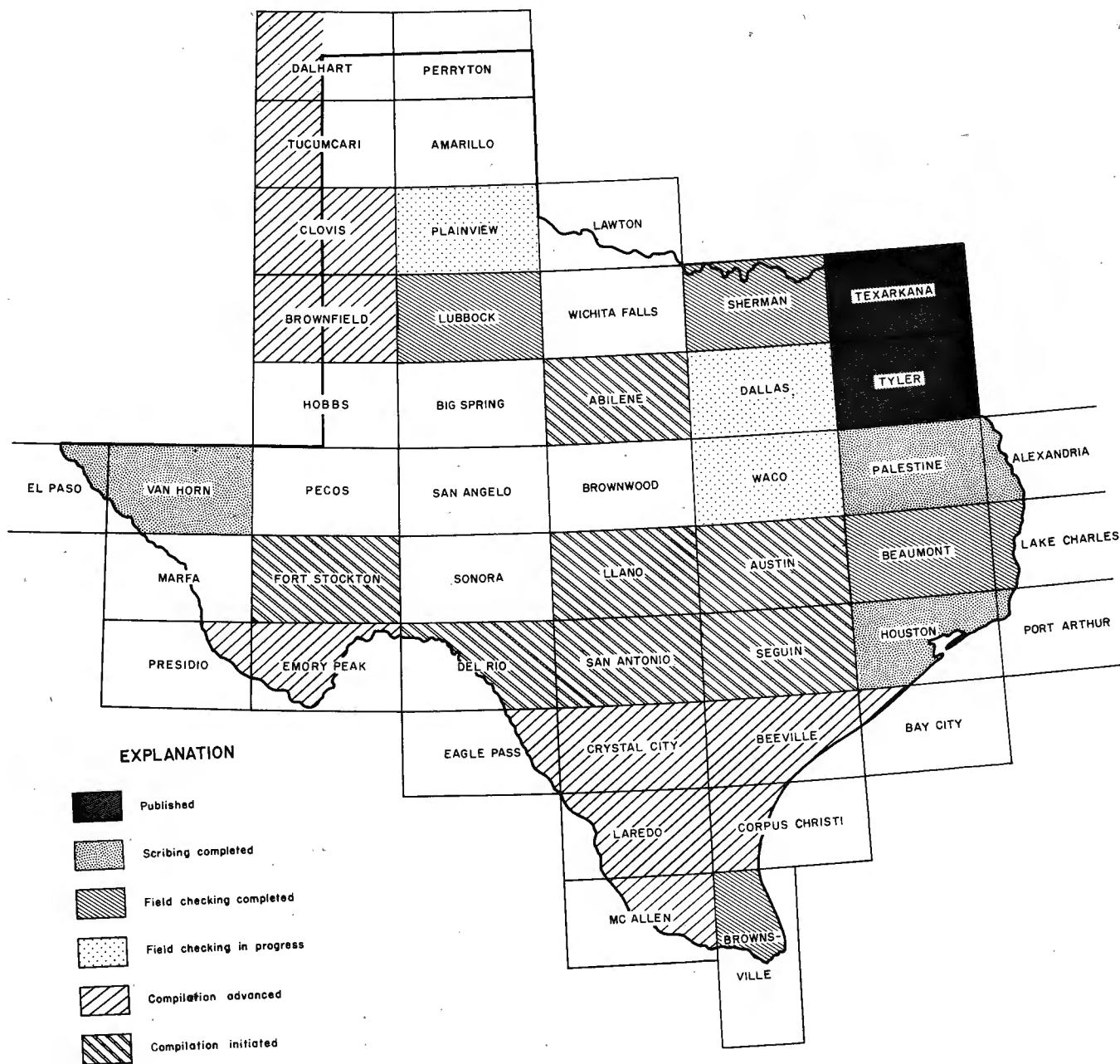
During the year the Marfa, Del Rio, and Eagle Pass Army Map Service 2° sheets were issued by the U. S. Geological Survey to complete the coverage in Texas.

Bureau members who worked on the Atlas Project during the year under the direction of Dr. V. E. Barnes include Mrs. C. A. Pieper (Texarkana and Sherman sheets), Dr. G. K. Eifler, Jr. (Lubbock sheet), Mr. C. A. Shelby (Texarkana, Palestine-Alexandria, and Beaumont-Lake Charles sheets), and Dr. J. W. Dietrich (Van Horn-El Paso sheet). In August Mrs. Pieper and Dr. Eifler attended the INQUA Congress in Denver.

During the summer, Dr. Saul Aronow, of Lamar State College of Technology, did field checking on the Quaternary part of the Beaumont-Lake Charles sheet and also prepared a geologic map for that area. Review of the Houston-Port Arthur sheet, which Dr. Aronow had field checked and prepared during the summer of 1963, has been delayed until the Beaumont-Lake Charles sheet is completed so that the entire width of the Coastal Plain Quaternary on the two sheets can be reviewed as a unit by the Geologic Atlas Project Committee of the Houston Geological Society. During the summer of 1963 Dr. Aronow also field checked most of the Quaternary of the McAllen-Brownsville sheet.

During August, Mr. Walter Haenggi field checked the Mexia fault system in the eastern part of the Dallas sheet and the northeastern part of the Waco sheet. Mr. J. H. McGowen, who had previously mapped the Paleozoic rocks and field checked the Cretaceous rocks in the western part of the Sherman sheet, completed the work on that sheet and continued the mapping southward into the Dallas sheet.

Mr. J. W. Macon, the Bureau's cartographer, supervises scribing, color separation, and preparation of all geologic atlas sheets for the press.



Geology of Austin and Vicinity

A discussion of the aims and progress of the Bureau's current study of environmental geology of the Austin area was included in the *Conference on Application of Geology and Soil Science to Urban Environmental Problems* held in Austin on September 13-14.

At the conference Dr. Peter T. Flawn stated, "Geologists and soil scientists believe that growing urban problems—in planning and in engineering systems—

can be dealt with more efficiently if city planners and engineers have more information made available to them on soils, foundation materials, resources, and earth processes. Neither geologists nor soil scientists have all the answers—together, we think we can develop most of the answers. The purpose of this meeting is to explore the ways of getting together to do the work and the best way to package it for users. It is clear, I think, that these questions can be answered more effectively if the users of the data can join in the discus-

sion and the discussion can focus on a specific problem. Therefore, City of Austin Engineers and Planners are here with us, and we shall talk about Austin."

Participants in the conference included representatives from Baylor University Geology Department, the Bureau of Economic Geology and other University of Texas departments, the City of Austin, Consulting Engineering Firms, Texas Highway Department, Texas Highway Department, Texas Research League, U. S. Geological Survey, and the U. S. Soil Conservation Service.

The participants discussed the kind of data that should be part of an ideal study in terms of: engineering properties of rocks and soils; resources, including water, construction materials, small dam sites, park and recreational resources, and agricultural lands (green belts); and earth processes, mainly hydrological. Dr. Flawn stated that a geologic map and soils map were basic to all phases of the study; interpretative maps can be derived from them to meet the needs of various users. (A detailed summary of the conference is available from the Bureau of Economic Geology upon request.)

During the first year of the Bureau's Austin Project, Mr. L. E. Garner of the Bureau staff located all active and inactive pits and quarries. Dr. P. U. Rodda, who with Dr. Keith Young of The University's Department of Geology is directing the project, began mapping south of the Colorado River in the Austin West quadrangle. Dr. Young completed mapping in the Austin East quadrangle and has advanced mapping in the quadrangle to the north. Mr. Garner mapped and sampled the sand and gravel deposits within the study area and mapped the terrace deposits of the Austin East quadrangle. With Dr. Young he completed the field work in that quadrangle. Mr. W. N. McAnulty, Jr., joined the Bureau staff in September and began mapping in the Austin West quadrangle along and west of the Balcones Escarpment.

During the summer, Dr. J. W. Dietrich, as part of the work on this Austin Project, supervised the coding of data contributed by private testing laboratories and State and Municipal agencies. Following his appraisal of the data, additional sampling, testing, and analyses will be scheduled.

Anticipating this forthcoming laboratory work, Mr. D. A. Schofield and Mr. J. T. Etheredge, of the Bureau's Mineral Studies Laboratory, visited labora-

tories of the Texas Highway Department at Camp Hubbard, Austin, and of The University of Texas College of Engineering to observe methods and equipment.

Areal Geologic Studies

The Moore Hollow Group of Central Texas. V. E. Barnes and W. C. Bell. A long-term stratigraphic and paleontologic study of Cambrian and immediately overlying Ordovician rocks of Central Texas. The project is complete except for sections on systematic paleontology and paleoecology.

Geology of the Cave Creek School and Monument Hill quadrangles, Texas. V. E. Barnes. Two more areal geologic maps scheduled to be compiled on new 7½-minute topographic base maps.

The Wilcox Group in Texas. W. L. Fisher. An investigation of the Carrizo-Wilcox sequence throughout the Texas Gulf Coast in outcrop and in subsurface down-dip through the Wilcox trend. The study involves stratigraphic delineation, interpretation of depositional history, and geometry of principal rock units based on measured outcrop sections, description of well cuttings and cores, and electric logs. Role of stratigraphy in the occurrence of mineral deposits (oil, gas, lignite, clay) is being stressed.

Midway-Upper Cretaceous stratigraphy in Central Texas. P. S. Morey. Definition of stratigraphic relations of Midway and Upper Cretaceous rocks in an area extending from Medina County to Lee County.

Geologic mapping in Trans-Pecos Texas. J. W. Dietrich, B. E. St. John, J. F. McKnight. Mapping of the Ocotillo, Presidio, and Ochoa quadrangles east of Presidio is complete and the map is in press. Mapping of the Black Gap area east of Big Bend National Park (including Marvavillas Canyon, Reagan Canyon, and part of the Bone Spring quadrangles) is also complete and the map is in press. Mapping of the Lajitas and Redford quadrangles is in progress.

Mineral Resource Studies and Mineral Statistics

Lower Cretaceous sands of Texas: stratigraphy and resources. W. L. Fisher and P. U. Rodda. The project included mapping (scale, 1:375,000) of various Lower Cretaceous sands and associated rock units in 30 counties of north, west, and north-central Texas.

Stratigraphy was investigated in terms of local and areal sequences, regional facies changes, and lateral variation in rock units. Stratigraphic nomenclature was revised to accord with regional changes in facies and convenient map units. As current and potential industrial mineral resources, Lower Cretaceous sands were considered in terms of distribution, quality, beneficiation, mining and processing methods, and marketing. Principal deposits were summarized. The study included physical and chemical analyses of approximately 175 samples from 110 localities. The manuscript has been completed and the report will be in press during early 1966.

Sand resources of Texas Gulf Coast. L. E. Garner. An investigation of stream and coastal sand deposits. The report will include a summary of the areal geology and a commodity survey.

Talc deposits of the Allamoore district, Culberson and Hudspeth counties. R. G. Rohrbacher. A study of the origin and distribution of the extensive talc deposits of the region.

Texas mineral resources. Roselle M. Girard and P. T. Flawn. A non-technical treatment of mineral resources in Texas, their significance in the economy, and conservation problems.

The annual compilation of Texas mineral production statistics and other mineral information. Roselle M.

Girard in cooperation with the U. S. Bureau of Mines. In progress as a continuing project.

Geology and Recreation

The Geologic Guide to the State Parks of Texas. R. A. Maxwell, editor. A general guide designed to tell the story written in the rocks, so that visits to the parks will be more meaningful.

The Geology of Palo Duro State Park. W. H. Matthews III, Professor of Geology, Lamar State College of Technology, Beaumont. A geological guide designed for visitors to the park.

Bibliographies and Catalogs

Bibliography and index to Texas geology, 1951-1960. Indexed by Margaret D. Brown, supervised by Roselle M. Girard. A bibliographic listing, with index, of publications pertaining to Texas geology. A continuation of previous Texas bibliographies and indices (Univ. Texas Bull. 3232, part 4, and Pub. 5910).

Catalog of type specimens of invertebrate fossils in the collections of the Bureau of Economic Geology. P. U. Rodda. An annotated catalog of about 5,000 separate specimens that have been described, figured, or listed in scientific publications.

Public Service

In addition to the basic scientific data developed and published through its research projects, the Bureau continued to supply direct information about Texas geology and minerals to many individuals and organizations.

All members of the Bureau's research staff provided information on request, either by conference or by correspondence. Two members spent a large portion of their time in this activity, namely, Roselle M. Girard, who during 1965 answered letters of inquiry from all over the State and Nation, and C. A. Shelby, who examined rock and mineral specimens submitted to the

Bureau for identification. W. L. Fisher consulted with representatives of Jack, Young, and Stephens counties regarding development of mineral products. Fisher's report was used in connection with a survey of potential railroad freight which could be generated within the three-county area.

Other public services included preliminary testing and evaluation of industrial rocks and minerals at the Mineral Studies Laboratory under the supervision of D. A. Schofield. The Well Sample and Core Library, under the supervision of P. S. Morey, offered facilities for the examination and study of the Library's vast collection of subsurface material from Texas wells.

Well Sample and Core Library

The Bureau's Well Sample and Core Library, with facilities at Balcones Research Center at the north edge of Austin, continued to receive and process large gifts of samples taken from boreholes drilled in the State.

During the year, Union Producing Company presented the contents of its Beeville well-sample warehouse to the Library. Included in this great volume of subsurface material were many samples taken in the early days of oil exploration along the Jackson-Yegua trend.

Under the supervision of Mr. Morey, the Library personnel—Messrs. M. L. Morrow, C. H. Hoker, G. T. Millegan, and J. O. Robinson—also continued to process sample material donated previously by Shell Oil Company. The sorting, packaging, labeling, and storing of this huge quantity of material are nearing completion.

The first phase of the planned expansion of Library storage space was completed in 1965 as workmen constructed a catwalk to link two warehouses at Balcones Research Center.

Mineral Studies Laboratory

The Mineral Studies Laboratory continued to support Bureau of Economic Geology research projects in 1965 by performing physical tests, chemical analyses,

spectrographic analyses, and evaluations of rocks and minerals of the State. In addition, the Laboratory made preliminary tests on samples submitted by individuals



The ARL 1.5 meter emission spectrograph in operation at the Mineral Studies Laboratory. The operator, Fernando D. Cortes, is a chemical engineering student employed as a laboratory assistant by the Bureau.

and companies and made recommendations for more extensive testing of some of the samples by specialized private laboratories.

Physical testing included separation of heavy minerals, mechanical analysis of a variety of rocks, and preliminary testing of the properties of clays. Chemical analyses included quantitative and qualitative analysis of rocks such as sands, limestones, shales, phosphorites, and tuffs. During the year, the Laboratory began revising its rapid method of testing to conform with the method described in U. S. Geological Survey Bulletin 1114-A, "Rapid Analysis of Silicate, Carbonate, and Phosphate Rocks." Cataloging of chemical reagents was completed in 1965.

Also completed was the renovation of the 1.5 meter ARL Spectrograph and the ARL Densitometer. A special item of \$2,500 for the renovation was used to purchase several major units, many minor units and small parts, supplies, and to pay for the services of the manufacturer's service engineer. Units purchased include an intensity control stand (ARL Model 2076-2060) for the spectrograph, an electronic voltage regulator (ARL Model 4900), and an electronic amplifier for the densitometer. A constant temperature developing machine (ARL Model 2300-2100) for spectrographic work also was purchased during the year.

Staff Activities

Scientific Meetings

Staff members represented the Bureau of Economic Geology at numerous scientific and professional meetings in 1965. Principal meetings attended during the year include:

American Association of Petroleum Geologists, 50th Annual Meeting, April, New Orleans, Louisiana—V. E. Barnes, P. T. Flawn, G. K. Eifler, Jr.

American Geophysical Union, Annual Meeting, April, Sessions on Planetary Sciences, Washington, D. C.—V. E. Barnes

American Geophysical Union, Western Meeting, September, Dallas, Texas—V. E. Barnes

American Institute of Mining, Metallurgical, and Petroleum Engineers, 94th Annual Meeting, February, Chicago, Illinois—W. L. Fisher, P. T. Flawn

Association of American State Geologists, Annual Meeting, May, San Francisco, California—P. T. Flawn

Computer Conference for Field or Province Geologists, University of Oklahoma, March, Norman, Oklahoma—J. W. Dietrich

Conference on Application of Geology and Soil Science to Urban Environmental Problems, September, Austin, Texas—V. E. Barnes, J. W. Dietrich, P. T. Flawn (Co-Chairman), L. E. Garner, P. U. Rodda

VII Congress of the International Association for Quaternary Research, University of Colorado,

August 29–September 4, Boulder, Colorado—G. K. Eifler, Jr., L. E. Garner, Mrs. C. A. Pieper

Geological Society of America, Annual Meeting, November, Kansas City, Missouri—V. E. Barnes, W. L. Fisher, P. T. Flawn

Geological Society of America, Southeast Section, April, Nashville, Tennessee—V. E. Barnes

Gulf Coast Association of Geological Societies, Annual Meeting, October, Houston, Texas—W. L. Fisher, P. T. Flawn, L. E. Garner, J. W. Macon, C. A. Shelby

Interstate Oil Compact Commission, Annual Meeting, December, Corpus Christi, Texas—W. L. Fisher, P. T. Flawn

International Union of Pure and Applied Chemistry (IUPAC) Congress, July, Moscow, U.S.S.R.—V. E. Barnes

Southwestern Federation of Geological Societies, Annual Meeting, January, Austin, Texas—J. W. Dietrich, G. K. Eifler, Jr., W. L. Fisher, P. T. Flawn, L. E. Garner, Roselle M. Girard, J. W. Macon, R. A. Maxwell, Mrs. C. A. Pieper, P. U. Rodda, C. A. Shelby

Texas Advisory Committee on Conservation Education, Annual Meeting, October, Lake Whitney, Texas—P. T. Flawn

West Texas Geological Society, Annual Field Trip, Geology of the Big Bend Area, Texas, October, Brewster and Presidio counties—J. W. Dietrich, R. A. Maxwell, C. A. Shelby

Lectures and Public Addresses

V. E. Barnes—

Devitrification of glass around bubbles in tektites: American Geophysical Union, Western Meeting, Dallas, Texas—September

Impact and cryptoexplosion structures: Geological Society of America, Annual Meeting, Field Trip 4, Rolla, Missouri—November

Original tektite crust: International Union of Pure and Applied Chemistry (IUPAC) Congress, Moscow, U.S.S.R.—July

Soil: source material for tektites: American Geophysical Union, Western Meeting, Dallas, Texas—September

J. W. Dietrich—

Volcanic rocks of Brewster and Presidio counties: West Texas Geological Society Annual Field Trip, Alpine, Texas—October

G. K. Eifler, Jr.—

The geology of petroleum: The University of Texas, Industrial and Business Training Bureau, Petroleum Training Lectures, Kilgore Junior College, Kilgore, Texas—September

The work of the Bureau of Economic Geology: Special Libraries Association, Austin, Texas—September

W. L. Fisher—

Geology of the Texas Gulf Coast province: Interstate Oil Compact Commission, Annual Meeting, Corpus Christi, Texas—December

Mineral resources and mineral industries of Eastland County: Eastland County Pilot Industrial Development Program, Eastland, Texas—January

Potential development of natural resources of south Texas: South Texas Electric Cooperative, Texas Industrial Planning Seminar, Austin, Texas—November

The search for nonfuel minerals: South Texas Geological Society, San Antonio, Texas—January

P. T. Flawn—

Geology and the new conservation movement: American Institute of Professional Geologists, Denver, Colorado—October

Geology and urban development: American Society of Civil Engineers, Houston Chapter, Houston, Texas—March

Geology in the State government of Texas: American

can Institute of Professional Geologists, Texas Section, San Antonio, Texas—September

Geology, minerals, and the new conservation movement: Interstate Oil Compact Commission, Annual Meeting, Corpus Christi, Texas—December

Minerals; final harvest or endless crop?: Southern Methodist University, Dallas, Texas—March; and Texas A&M University, College Station, Texas—May

J. W. Macon—

Photogrammetry and photo-interpretation: The University of Texas, Graduate Class in Civil Engineering, Austin, Texas—March

R. A. Maxwell—

Geology as a profession: O'Henry Junior High School, Austin, Texas—March

Geology of the Big Bend National Park: A summary: West Texas Geological Society Annual Field Trip, Alpine, Texas—October

History and legendary treasures of the Big Bend Country: William B. Travis High School, Austin, Texas—February

P. U. Rodda—

Fossils: Friday Mountain Boys Camp, Friday Mountain, Hays County—August

Academic Assignments, Committee Service, and Other Professional Responsibilities

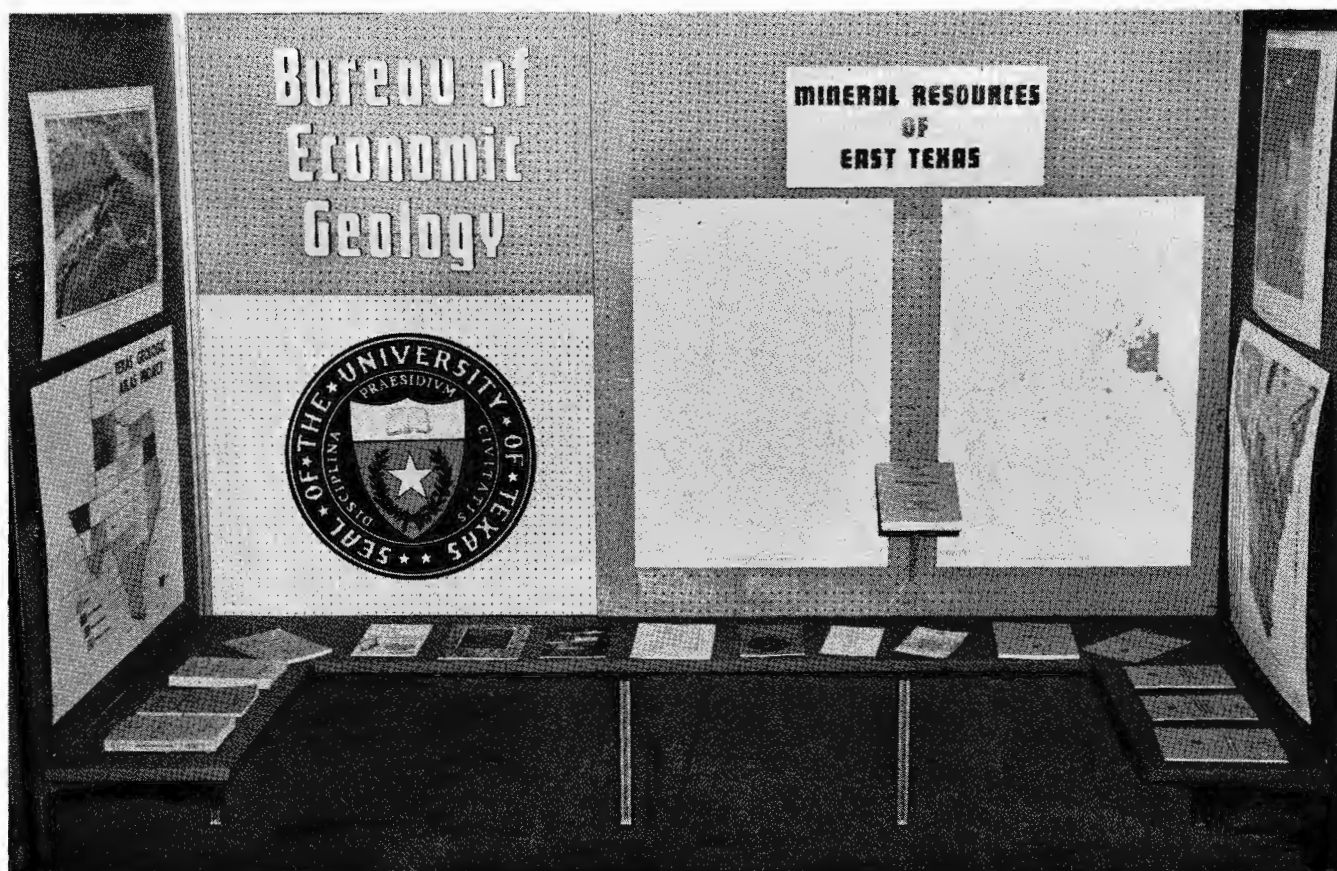
In addition to their regular Bureau duties, members of the Bureau of Economic Geology staff served during 1965 in numerous outside assignments, which included the following:

V. E. Barnes—

Llano County Historical Society, Dedication of the Plaque Commemorating the "Old Salt Works" of Llano County. Dr. Barnes, who prepared the geological explanation for the presence of the salt that is inscribed on the plaque, took part in the April 11 dedication by delivering a talk on the geologic history of the salt deposit.

Rice University, Department of Geology: Supervision of Kenneth J. Balacek's Master's thesis, "Radioactivity in Tektites."

The University of Minnesota, Department of Geology: Supervision of George Seddon's Ph.D. dissertation, "Conodonts of Relict Formations of Central Texas."



Bureau of Economic Geology exhibit, built by James W. Macon, and displayed at scientific meetings in Austin and in Houston during 1965.

The University of Texas, Department of Geology:
Professor of Geology.

J. W. Dietrich—

Austin Geological Society: Scouting Committee;
Steering Committee for Organization of the So-
ciety; Technical Programs Committee.

West Texas Geological Society: Co-Leader of 1965
Annual Field Trip, "Geology of the Big Bend
Area, Texas."

G. K. Eifler, Jr.—

American Association of Petroleum Geologists:
Representative, Austin District (until April 1965).

American Institute of Professional Geologists, Texas
Section: Legislative Committee.

Austin Geological Society: Public Relations Com-
mittee, Chairman.

Southwestern Federation of Geological Societies:
Courtesy Committee of 1965 Annual Meeting,
Chairman.

W. L. Fisher—

The University of Texas, Department of Geology:
Lecturer

P. T. Flawn—

American Association of Petroleum Geologists:
Basement Rocks Projects Committee, Chairman;
Committee on Preservation of Well Samples and
Cores; Research Committee.

American Institute of Mining, Metallurgical, and
Petroleum Engineers, Industrial Minerals Divi-
sion: Membership Committee.

American Institute of Professional Geologists, Texas
Section: Nominations Committee; Screening
Committee.

Association of American State Geologists: Repre-
sentative to the American Geological Institute.

Austin Geological Society: President.

Southwestern Federation of Geological Societies:
Program Committee of 1965 Annual Meeting,
Chairman.

Texas Advisory Committee on Conservation Educa-
tion.

Texas Mapping Advisory Committee.

The University of Texas: College of Arts and Sci-
ences, Faculty Council Representative. Depart-

ment of Geology, Professor of Geology (1965 teaching assignment: "Mineral Resources"). Publications Committee, Chairman.

U. S. Corps of Engineers, Mineral Resources Study Group: Committee for a Comprehensive Study of the Red River Below Denison Dam.

J. W. Macon—

Designed and supervised the preparation of Bureau of Economic Geology exhibits at the following meetings: Gulf Coast Association of Geological Societies, Houston; South Texas Geological Society, Corpus Christi; Southwestern Federation of Geological Societies, Austin; and The University of Texas Round-Up, Austin.

R. A. Maxwell—

Austin Geological Society: Scouting Committee, Chairman.

Texas Academy of Science: Visiting Scientist Program, Lecturer to High-School Groups.

West Texas Geological Society: Co-Leader of 1965 Annual Field Trip, "Geology of the Big Bend Area, Texas."

P. U. Rodda—

Southwestern Federation of Geological Societies: Committee on Publications and Editing for 1965 Annual Meeting, Chairman.

The University of Texas, Department of Geology: Lecturer.

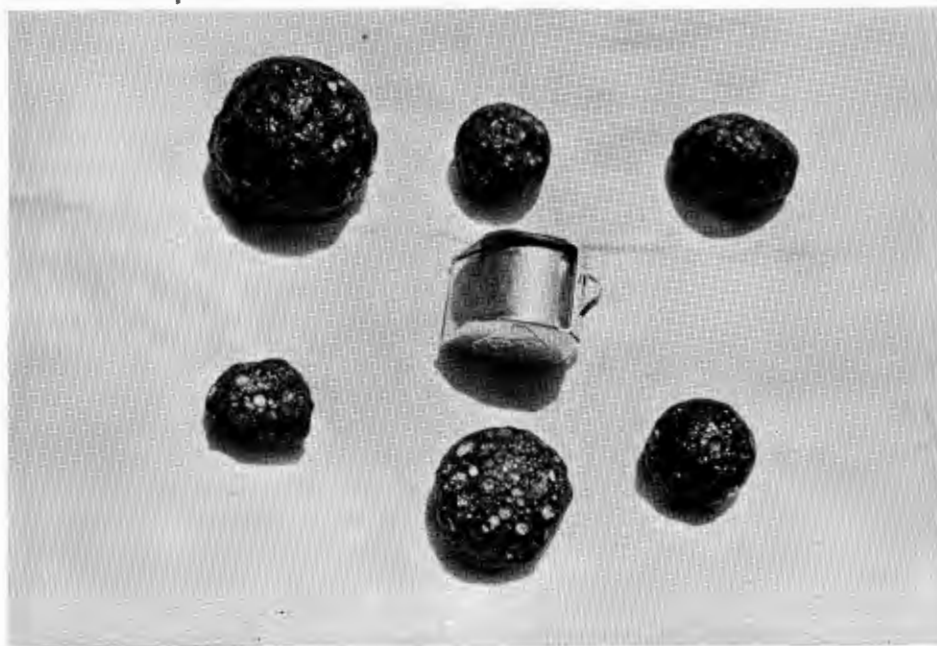
Tektite Research

Dr. Virgil E. Barnes, Associate Director of the Bureau of Economic Geology, is an internationally known expert on tektites—naturally occurring glassy objects of unknown origin which are currently of great scientific interest because of possibilities of a lunar origin.

Following are extracts from a journal kept by Dr. and Mrs. Barnes during their recent world tour of tektite localities.

Tektite research during the year was a continuation of research supported since June 1, 1960 by National Science Foundation grants administered by The University of Texas. Again, as in 1960 (see *GeoTimes*, vol. 6, no. 2, p. 8, 1961), we were able to combine tektite field research in various countries around the world with attendance of an International Geological Congress. This period of geological field examination of tektite occurrence and impact features was between October 10, 1964 and February 23, 1965.

We travelled to Senegal, Sierra Leone, Ivory Coast, Ghana,



Ivory Coast tektites received as a gift from the Chief of the village of Ouéllé-Koumanou.

South Africa, Kenya, India, Thailand, Malaysia, Hong Kong, Macao, and the Philippines.

Organizations directly cooperating in the research include SODEMI (Société pour le Développement Minier de la Côte d'Ivoire), M. Guy Cotton, Directeur Général, and Mr. Bernard Tagini, Directeur Technique; Ghana Geological Survey, Mr. J. E. Cudjoe, Director, and Mr. J. G. A. Renner, Deputy Director; Geological Survey Division, Department of Mineral Resources, Thailand, Dr. Kaset Pitakpaivan, Chief Geologist; and Philippine Bureau of Mines, Mr. Francisco Comsti, Chief Geologist.

Ivory Coast so far is the source of the only tektites found in West Africa. In addition to collecting tektites from the Ivory Coast tektite strewn-field and glass from the Bosumtwi crater, it was our purpose to try to extend the known area of occurrence of Ivory Coast tektites in West Africa beyond the present limits and to determine whether the Bosumtwi crater could possibly be the source of these tektites.

Most of the area in the countries visited is covered by jungle and for this reason the search to broaden the area of tektite occurrence was mainly carried on in areas of large alluvial mining operations as well as in places where large volumes of alluvium are moved, such as at the Volta River Project at Akosombo in Ghana. Alluvial diamond mines visited included SLST at Yengema in eastern Sierra Leone, where a kimberlite pipe has recently been found. Kimberlite dikes had been known there for some time.

While visiting the gold dredging operation of the Bremang Gold Dredging Company, Ltd. at Dunkwa, we had the pleasure of visiting with U.T.'s Peace Corps geologist, Robert Fakundiny. The dredging operation recovered many artifacts, gold weights, and ancient jewelry, but so far no tektites have been reported.

Mr. John Renner of the Ghana Geological Survey joined us for 10 days of our travels in the Ivory Coast and later for the investigation of Bosumtwi crater in Ghana and the area between the crater and the Ivory Coast border. The known field of Ivory Coast tektite occurrence is a small area in the Baoulé region, where tektites originally were found 30 or 40 years ago by the local inhabitants in the course of test-pitting during gold prospecting and mining operations. Some of these tektites reached the Muséum National d'Histoire Naturelle in Paris. Since that time, the raising of cocoa and coffee has proven more profitable than mining gold as a source of income for the villagers and now tektites are seldom found.

The very rarity and aura of mystery surrounding the tektites (known to the local inhabitants as "agna"), which brought them to attention in the first place, also contributed to the reluctance of the villagers to admit that they had them and to part with them. In this, the Polaroid camera proved indispensable and the lure of on-the-spot pictures drew out the first six tektites we were able to obtain.

We had been given letters by M. Cotton to the Sous-Préfets of the districts in which we planned to travel, and our first objective at each district center was to visit the Sous-Préfet's office to explain our mission. We were received with courtesy and were assisted by means of letters to local chiefs and by guides

and messengers. At Bouna the Sous-Préfet called in the hunters, showed them the tektites we had with us, asked whether they had found such things, and were told to bring in any they found. Requests were left in all the villages we visited to send any tektites found to SODEMI, and a small reward was offered. Altogether, we recovered 10 Ivory Coast tektites within the boundary of known tektite occurrence and obtained high silica glass of completely different character in breccia at Bosumtwi crater.

The attempt to find tektites in West Africa beyond the borders of the known strewn-field has not yet yielded additional tektites, although in October of this year M. Guy Cotton, Director of SODEMI, sent 5 specimens collected within part of the area of known occurrence in the triangle between Adzopé, Agboville, and Bongouanou. M. Cotton also reported that SODEMI had procured a flattened ellipsoidal specimen measuring 8 by 4 cm and weighing 350 gms. The missionary work we did in acquainting people about the possible presence of tektites will, we hope, call attention to specimens which may turn up in the other areas we visited.

The next objective was to have a look at the Vredefort ring in South Africa, which has been postulated to be of impact origin. This puzzling circular feature, 130 miles in diameter, shows outwardly overturned beds, pseudotachylytes, and shatter cones. Descriptions of the occurrence of pseudotachylyte there led to a paper in 1940 (Barnes, U. T. Pub. 3945, pp. 645-654) pointing out the similarity between veins in stony meteorites and pseudotachylyte. Although proponents of the impact theory stoutly maintain that shatter cones and pseudotachylyte can be formed only by impact, this is not proven. Most of the South African geologists and geophysicists with whom we spoke, except W. I. Manton (who spoke on impact features at a technical session at The University of Texas in the fall of 1964), prefer to consider a different origin for the Vredefort structure.

We paused briefly in Kenya to make connection with the twice-weekly plane to Karachi, en route to the International Geological Congress in India. While in Kenya, we saw a great many beautiful animals in game sanctuaries.

Following the International Geological Congress in New Delhi and a field trip to the Jaipur, Ajmer, Udaipur area of Rajasthan, we followed much the same route through southeast Asia—Bangkok, Kuala Lumpur, Hong Kong, and Manila—as we did four years earlier.

When we reached bustling Bangkok with its oriental charm we were on familiar ground again, and the rest of the trip was spent in extending the breadth of tektite sample coverage, while seeing old friends and making new ones. Dr. Kaset, as four years previously, went all out to see that we got to the places from which we needed tektite collections. He asked his friends Mr. Inthong Suwanayuen and Mr. Thuan Damrongmanee to aid us in getting to tektite localities and assigned Mr. Virat Mahakaphongs to accompany us. Mr. Inthong took us to his tin mine in Chiangrai Province near the Burma border. At Ban Pong Thawi near one of Mr. Inthong's worked-out mines, the villagers provided an excellent collection of tektites for our research.

Mr. Thuan took us to his Mae-Jong manganese mine in

Lampoon Province. Here the miners brought us tektites while we had lunch. Between Chiangmai and Mae-Jong we visited a laterite quarry for building blocks where tektites are found in laterite. The nearby village has the intriguing name of Pra-Bath-Tak-Pah, which we were told means "The footprint of Buddha."

In Malaya tektites seem to be scarce, only three were in the Survey collection and these were photographed. Others are found during tin mining operations on the east side of the Malay Peninsula but are kept as talismen by the Chinese miners.

We had the pleasure of seeing perhaps the largest alluvial tin mining area in the world—the Kenta Valley region near Ipoh. As we flew along this valley we saw hundreds of dredges and the great area of spoil where the tin had been mined. The whole course of the river had been changed in order that no tin-bearing alluvium would be missed.

In Hong Kong and in Macau we searched for tektites that might have come in from the Leichow Peninsula or other places in Communist China and for possible channels for getting tektites from there. Since the Leichow Peninsula is not far from Hong Kong, we also checked the New Territories for the possible presence of tektites but found none.

We had the good fortune to meet Dr. C. J. Peng who had worked with the South China tektites while at the University of Peking. A former assistant of his at the University of Peking has described the Chinese tektites, documenting perhaps the earliest written record of tektites (see Da-Ming, Lee (1963) A preliminary survey and study of the tektites—Lei-Gong-Mo from Leichow Peninsula and Hainan Island, China: *Scientia Geologica Sinica*, No. 1, pp. 42–49, Institute of Geology, Academy of Sciences of China, Peking, China). The Lei-Gong-Mo, meaning inkstones of the God of Thunder, were first mentioned, so far as is known, by Liu Sun of the T'ang Dynasty in the middle of the 10th Century, in his book entitled *Ling Piao Lu Yi*, or "Notes on the Wonders beyond the Nanking Mountains in Kwangtung." This was a good 800 years before the mention of Bohemian tektites by Josef Mayer in 1787.

In the Philippines Mr. Comsti of the Bureau of Mines had a locality staked out for us to visit on Calagnaan Island off the northeast coast of Panay Island. Mr. Cipriano Llave of that Bureau accompanied us to this island where we were the guests of Mr. Rosendo Lacson who guided us to the various clay pits where tektites were thought to be occurring in the clay, an alternation product of the volcanic rocks of the area. The tektites proved to be coming out of the overburden rather than the clay.

Mr. Jose Santiago of the Bureau of Mines accompanied us to Cauayan in Isabela Province where Dr. Angeles F. Reyes let us use his jeep. We were unable to visit the tektite deposit in the vicinity of Santiago and Cordon because of high water, but we did find a new locality from which we obtained a collection south of Ilagan.

We now have three well-documented collections from the Philippines, including the one from Cabaruyan Island collected

four years previously, which give valuable information on variations on philippinites within their strewn-field. Additional well-documented collections are needed throughout the Philippines, but these to be of most value must be collected by a geologist interested in the geologic occurrence of these fascinating objects. Unfortunately, little geological data accompany the enormous collection of philippinites in the Museum and Institute of Archaeology and Ethnology, University of the Philippines. The Philippine Islands, therefore, remain a fertile area for field research on the geologic occurrence of tektites.

All collections which were shipped and all film which was mailed reached Austin safely. The collections are now being processed for study and we hope more evidence will be found, in the wealth of material collected, pointing to the correct theory of the origin of tektites.

Meetings attended during the year in connection with tektite research include: American Geophysical Union meetings in Washington and Dallas, Geological Society of America meetings in Nashville and Kansas City, and the International Union of Pure and Applied Chemistry Congress (IUPAC) held in Moscow. The Kansas City and Moscow meetings furnished strong contrast—in Kansas City evidence supporting only the lunar origin of tektites was presented, while in Moscow evidence supporting only the terrestrial origin of tektites was on the agenda. However, in Moscow it was recognized that a cosmic event probably was involved in the formation of tektites on earth. While in Moscow Prof. Vinogradov arranged a visit to the Vernadsky Geochemical Institute.

During July and August two weeks were spent in the tektite strewn-fields of Moravia and Bohemia visiting tektite localities and making collections. Prof. Rudolf Rost of Charles University made arrangements for the field work in Czechoslovakia and for this we are truly grateful. We were fortunate in being assigned Václav Novák, a student, as a guide. He knew all the tektite localities and collectors of tektites. Prof. Jirí Konta of Charles University joined us for two days in Bohemia and, in addition to demonstrating the geologic occurrence of moldavites to us, led us to rich collecting sites, then gave us all the moldavites that he and his party found.

Visitors during the year drawn to Austin by the tektite research include, in order of their arrival: Dr. L. S. Walter, Goddard Space Flight Center, Greenbelt, Maryland, to examine additional sections of Muong Nong-type indochinites for coesite. His original identification of coesite in indochinites was from specimens sent to him from our collection. Dr. Dean Chapman and Mr. LeRoy Scheiber, NASA, Ames Research Center, Moffett Field, California, measured the densities of tektites collected during our around-the-world trip, thus not only enhancing their data but giving us basic information aiding selection of material for detailed study. Dr. E. P. Henderson, U. S. National Museum, Washington, D. C., viewed the tektite collection and discussed acquisition of tektites from Ivory Coast. Prof. Jirí Konta viewed the tektite collection and discussed tektite research as well as additional cooperative work on moldavites following the 1968 International Geological Congress in Prague.



New Geology Building—view from the west, November 1965. The Bureau will occupy the fifth (top) floor of the \$2.25 million dollar structure.

Work Progresses on New Geology Building

Construction of the new five-story Geology Building, located on the east side of The University of Texas Main Campus, is progressing ahead of schedule. Concrete has been poured for the fifth-floor level, and completion of the 2¼ million building is expected in December 1966.

Classrooms, laboratories, and offices of the Department of Geology will occupy the first four floors, and the Bureau of Economic Geology will be located on the fifth floor. The Well Sample and Core Library and the Mineral Studies Laboratory will remain at Balcones Research Center.

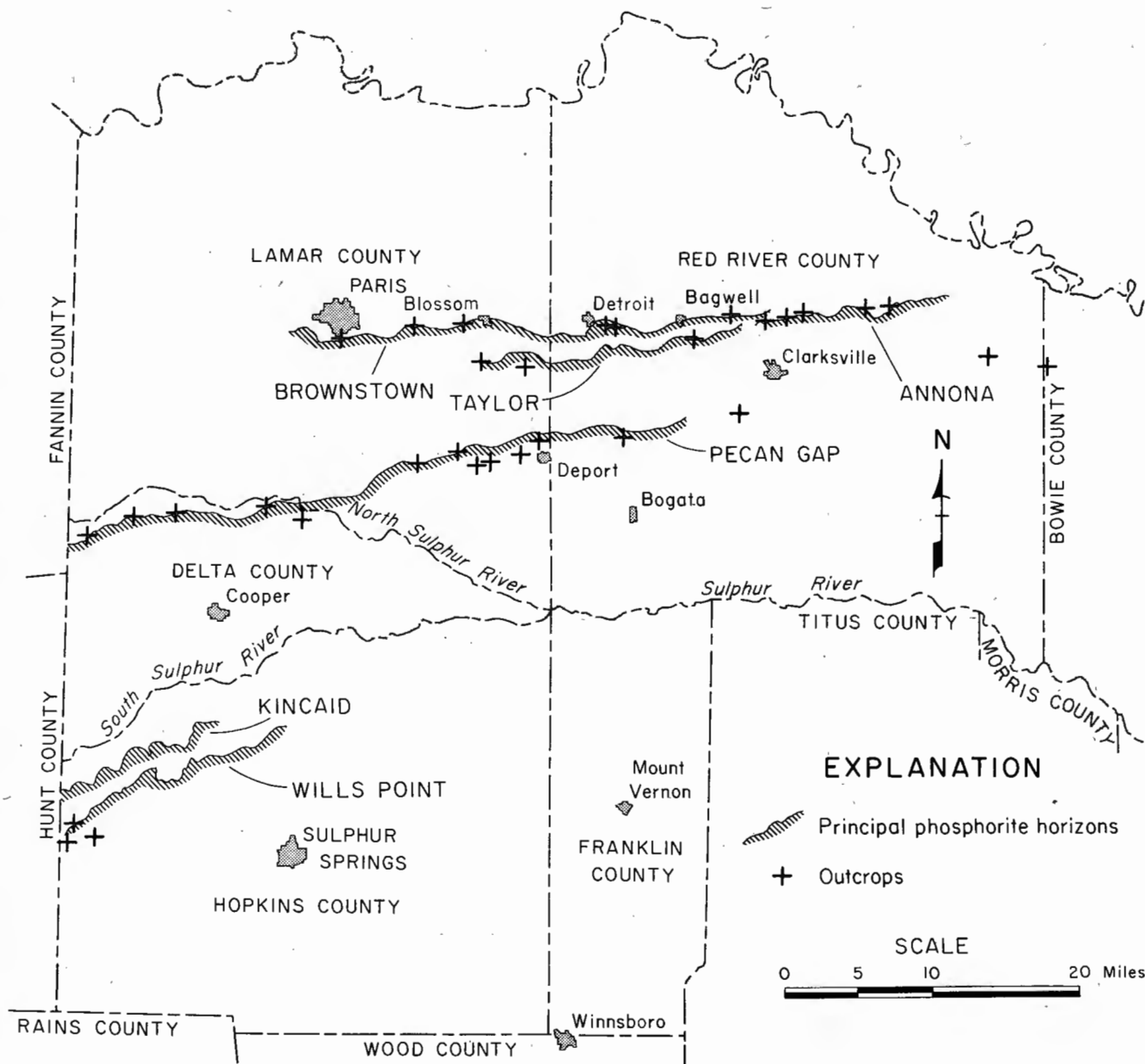
Bureau Publication Inventories Mineral Raw Materials of East Texas¹

East Texas contains an abundance and variety of mineral raw materials. In order to inventory these materials and to appraise the potential for a broader-based

mineral industry, the Bureau conducted a 30-month study of East Texas. Encompassing 42 counties that cover an area of 33,000 square miles, the study was supported in part by a \$40,000 contract with the Area Redevelopment Administration of the U. S. Department of Commerce (see p. 2).

In 1965, the Bureau published results of the study

¹ Rock and mineral resources of East Texas, by W. L. Fisher, with contributions by C. R. Chelf, C. A. Shelby, L. E. Garner, D. E. Owen, and D. A. Schofield: Univ. Texas, Bur. Econ. Geol. Rept. Inv. No. 54, 439 pp., 71 figs., 6 pls., 49 tables, August 1965.



Principal phosphorite horizons in northeastern Texas. (Bureau Econ. Geol. Rept. Invest. No. 54, fig. 57.)

in a report that includes discussions of mineral abrasives, agricultural minerals, aggregate and base materials, asphalt and related bitumens, cement and cement materials, chalk and limestone, clay and clay materials, gemstones, greensand, heavy minerals, industrial sands, lignite and lignite products, metallic ores (chiefly iron ore), mineral fillers and pigments, peat, phosphorite, pozzolanic materials, refractory materials, salt and associated minerals, constructional sand and gravel, crushed and dimension stone, and volcanic ash.

Industries based on the processing of clays, iron ore,

and salt in East Texas are currently well developed in relation to available markets. Other resources are undeveloped or only partly developed. The continued population increase and the growth of cities within the existing trade area, together with technological advances in the processing and marketing of mineral raw materials, will provide the stimulus for possible greater development of East Texas mineral resources and mineral industries.

The Bureau's report is designed to give data basic to such development. It treats the occurrence, distribu-

tion, geology, reserves, quality, production, mining and processing, current and potential utilization, and pro-

duction costs of principal East Texas mineral commodities.

Secretary Udall Initiates Nationwide Study of Strip and Surface Mining

Under the Appalachian Regional Development Act of 1965 (Public Law 89-4, Title II, Section 205(c)), the Secretary of the Department of the Interior is authorized to make a survey of strip and surface mining

and their effects in the United States. Governor Connally has designated Dr. Peter T. Flawn, Director of the Bureau of Economic Geology, as the contact man for Texas in this study.

Frank Alfred Herald 1887-1965

Frank A. Herald, pioneer petroleum geologist and petroleum engineer, died quietly in his sleep at his home in Austin on November 12, 1965. Mr. Herald occupied many important positions in the oil industry during a career that spanned the years from 1910 to 1948 and included duties in Europe, China, and Mexico, as well as in the United States. He organized the oil and gas section of the U. S. Bureau of Internal Revenue and was senior engineer with the U. S. Securities Exchange Commission.

Following retirement from industry in 1948, Mr. Herald joined the staff of the Bureau of Economic Geology as a Research Scientist, where he remained until 1957. While at the Bureau, he edited two comprehensive volumes on Texas oil fields: "Occurrence of Oil and Gas in Northeast Texas," which was published in 1951 as University of Texas Publication 5116, and "Occurrence of Oil and Gas in West Texas," published in 1957 as University of Texas Publication 5716.

Mr. Herald will be remembered for his many contributions to the oil industry; for his integrity and understanding; for his dedication to careful, thorough workmanship; and for his love of his family, his friends, and his garden.

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