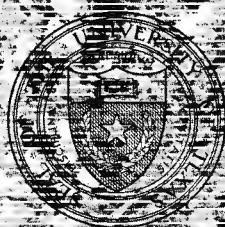


The University of Texas

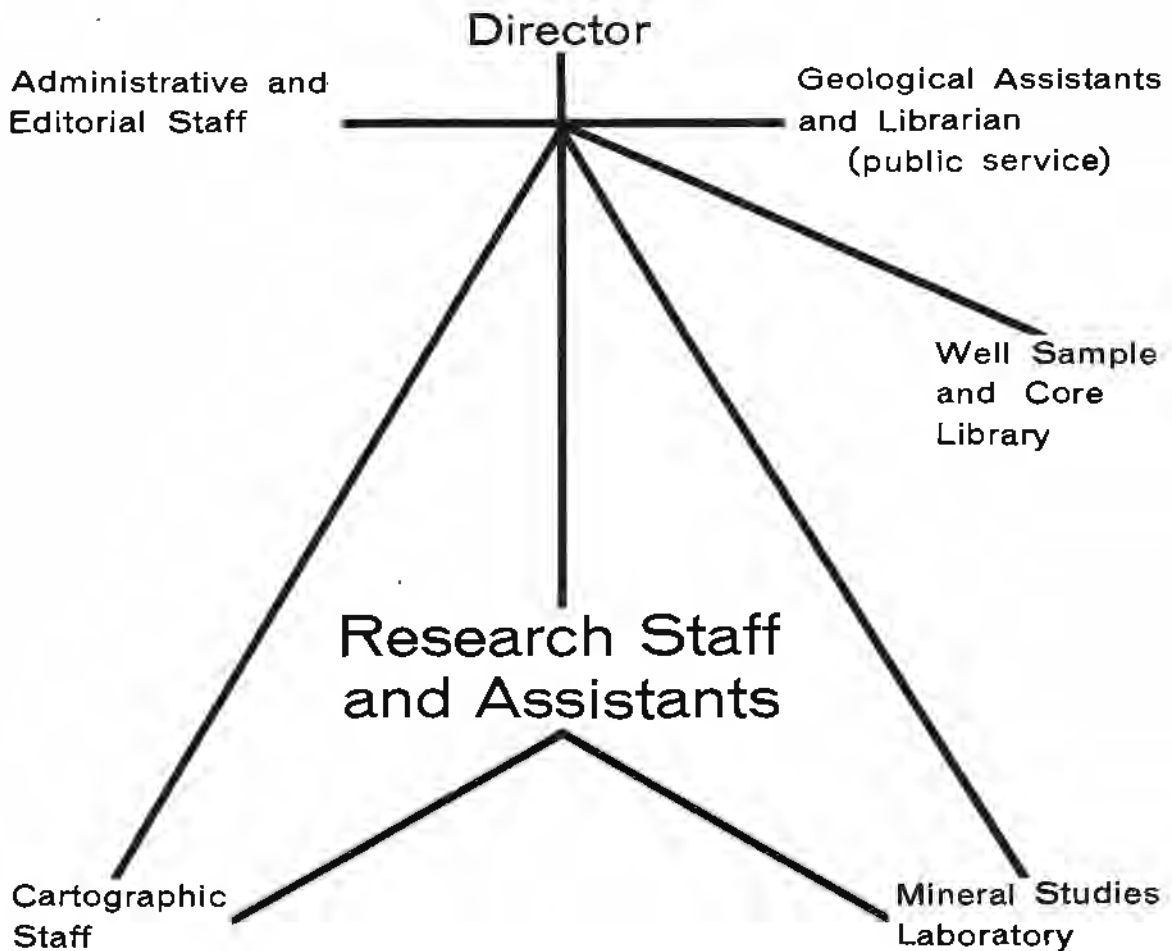


Bureau of Economic Geology

Report
for
1962

BUREAU OF ECONOMIC GEOLOGY

TABLE OF ORGANIZATION



Cover photograph. Acetate-peel print of high-calcium Edwards Limestone, Real County, Texas, showing cross sections of pelecypod and gastropod shells. Magnification X10.

THE BUREAU OF ECONOMIC GEOLOGY is one of the organized research bureaus of The University of Texas. Established in 1909, it has for 53 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) investigations of mineral deposits, (3) systematic geologic mapping, and (4) public service mineral information, identification and testing, and compilation of mineral statistics. 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 Investigation, Geologic Quadrangle Maps, Guidebooks, and Mineral Resource Circulars. The Guidebooks include non-technical publications of general interest.

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 1962

In 1962 the Bureau of Economic Geology published: (1) two major reports in The University of Texas Publication series (Nos. 6120 and 6210); (2) Report of Investigations Nos. 43, 45, 46, 47, and 48; (3) Geologic Quadrangle Map No. 24; (4) Mineral Resource Circulars No. 43 and No. 44; and (5) a new list of Texas mineral producers.

Publication 6120. THE OUACHITA SYSTEM, by P. T. Flawn, August Goldstein, Jr., P. B. King, and C. E. Weaver. 401 pp., 13 figs., 15 pls., 2 geologic maps in color, May 1962 \$4.00

This report, the result of a 5-year project which involved extensive cooperation between the oil industry and the Bureau of Economic Geology, presents the results of a comprehensive study of the Ouachita system—a major structural feature of southern United States and Mexico. The main purpose of the project was to distinguish the major geologic elements of this largely concealed system and to evaluate the oil and gas potential of its frontal structures. The project included detailed petrographic studies of samples from wells which penetrated rocks of the system.

The major chapters include: (1) an introduction, with discussions of methods of study and structural, stratigraphic, and petrographic nomenclature; (2) summary chapters on the geology of the various exposed parts of the Ouachita system; (3) the subsurface Ouachita structural belt in Texas and southeast Oklahoma; (4) the subsurface Ouachita structural belt east of the Ouachita Mountains; (5) the Ouachita structural belt in Mexico; (6) igneous rocks and vein rocks in the Ouachita belt; (7) metamorphism; (8) post-orogenic Paleozoic rocks; (9) foreland basin and shelf rocks; (10) clay minerals; (11) tectonics; (12) history of the Ouachita system; and (13) economic possibilities.

The appendix lists individual summary reports on wells penetrating rocks of the Ouachita system and adjacent foreland. Two large colored geologic maps present data on stratigraphy, structure, metamorphism, and well control from Alabama to Mexico.

Publication 6210. ANNOTATED BIBLIOGRAPHY, AND INDEX, OF CONODONTS, by S. P. Ellison, Jr. 128 pp., 6 charts, June 1962 \$2.25

Since the discovery of conodonts in Ordovician strata of Estonia in 1854, more than 1,050 articles about conodonts have appeared. More than 220 genera and more than 2,400 species have been proposed. Specimens have been collected from a wide variety of rocks ranging from Cambrian to Cretaceous from all of the continents. This report consists of (1) the bibliography; (2) the stratigraphic, geographic, and subject index; and (3) the index to genera. The combined organized data are designed as a tool for future investigations and research on conodonts.

Report of Investigations No. 43. MINERAL RESOURCES

OF SOUTH TEXAS: Region Served Through the Port of Corpus Christi, by Ross A. Maxwell. 140 pp., 7 figs., 5 pls., 44 tables, May 1962 \$2.50

This report, published in cooperation with the Corpus Christi Chamber of Commerce, is a compilation of all available data on mineral resources (exclusive of oil and gas) in 39 south Texas counties; it provides an inventory of mineral resources in the trade area served through the Port of Corpus Christi. Resources treated in the paper include: (1) For the northwestern part of the trade area in and associated with Cretaceous formations—high-calcium limestone, Portland cement materials, clay for structural clay products, asphaltic limestone, gravel, manganese, barite, celestite, and guano. (2) For the Gulf Coastal Plain Tertiary and Quaternary formations—uranium minerals, industrial sand, gravel, bleaching clay, drilling mud, expanded clay aggregate, structural clay products materials, caliche, crushed stone, peat, lignite, bituminous and cannel coal, salt, gypsum, sulfur, and oyster shell. Descriptions and evaluations are supported by analytical data. The accompanying illustrations give location of resources within the various counties.

Report of Investigations No. 45. PLEISTOCENE MOLLUSCAN FAUNAS AND PHYSIOGRAPHIC HISTORY OF PECOS VALLEY IN TEXAS, by A. Ryron Leonard and John C. Frye. 42 pp., 4 figs., 4 pls., July 1962 \$1.25

The Pecos River extends—in Texas—in a southeasterly direction from northern Reeves and Loving counties, at the Texas-New Mexico boundary, to southern Val Verde County, where it joins the Rio Grande. Four extensive pedimented surfaces that occur southwest of the river from the Davis Mountains to near the present channel are described. Surface I was graded to the late Tertiary Ogallala drainage; Surface IV developed during latest Wisconsinan and during Recent time as a terrace in which the Pecos River is presently incised.

In this report, the physiographic features of the Pecos River valley are illustrated by generalized profiles and photographs. The 33 localities from which fossil mollusks were collected are indicated on a location map, and the species included in each local molluscan faunal assemblage are shown on a chart. Each species is illustrated.

Report of Investigations No. 46. A STRATIGRAPHIC DATUM, CISCO GROUP (UPPER PENNSYLVANIAN), BRAZOS AND TRINITY VALLEYS, NORTH-CENTRAL TEXAS, by L. F. Brown, Jr. 42 pp., 3 figs., 8 pls., 2 tables, October [November] 1962 \$3.50

This report presents results of a study made to establish a reliable stratigraphic datum with continuity demonstrated by detailed mapping. The persistent rock units involved are the Blach Ranch and Breckenridge Limestone Members of the Thrifty Formation in the Cisco Group of the Brazos and Trinity River valleys, Jack and Young counties. A major contribution of the paper is correlation between the sequences in the two valleys, especially in Young and Jack counties. Four maps in color show the Blach Ranch, Breckenridge, and unnamed lime-

stone and unnamed sandstone in southwestern and eastern Young County and western and northeastern Jack County. A columnar cross section is included of the upper part of Thrifty and lower part of Harpersville(?) Formations, Jack and Young counties. Classification and correlation of mapped rock units, Thrifty and lower part of Harpersville Formations, are given in one of the tables, and key rock units in the same formations mapped and described in the report compose the second table.

Report of Investigations No. 47. UPPER FRANCONIAN AND LOWER TREMPLEALEUAN CAMBRIAN TRILOBITES AND BRACHIOPODS, WILBERNS FORMATION, CENTRAL TEXAS, by W. Charles Bell and Howard L. Ellinwood. 39 pp., 14 pls. Reprinted from *Journal of Paleontology*, vol. 36, no. 3, May 1962 \$1.00

Forty-three species of trilobites belonging to 28 genera, 12 species of brachiopods belonging to 8 genera, and one species of gastropods are described from the Morgan Creek, Point Peak, and San Saba Members of the Wilberns Formation in the Llano Uplift. Systematic descriptions include one new trilobite genus, six other new trilobite species, one new brachiopod genus, two new brachiopod species, and one new brachiopod subspecies. All illustrations are stereographic.

Report of Investigations No. 48. THE HILLSHULER LOCAL FAUNAS OF THE UPPER TRINITY RIVER, DALLAS AND DENTON COUNTIES, TEXAS, by B. H. Slaughter, W. W. Crook, Jr., R. K. Harris, D. C. Allen, and Martin Seifert. 75 pp., 17 figs., 1 pl., December 1962 \$2.50

The Pemberton Hill—Lewisville (T-2) terrace deposits of the Trinity River in Dallas and Denton counties are divided into four consecutive members. Sixty-three vertebrates, thirty-two mollusks, and several insects and plants have been collected from three members and are discussed. Fluorine-uranium-nitrogen tests on fossil material from each member indicate that the entire unit is a single depositional sequence with a short time span. During this period there were local extinctions and new arrivals which probably reflect change of climate from more humid to more arid than is present in the area today. The terrace deposits are tentatively referred to the Sangamon interglacial stage on the basis of two radiocarbon dates in excess of 37,000 years BP and on the association of the giant bison, *Bison alleni*, with a typical interglacial fauna. Other Trinity River terraces and local archeology are described, and stratigraphic and faunal relationships with other well-known fossil localities in Texas, Oklahoma, and Kansas are suggested.

Geologic Quadrangle Map No. 24. GEOLOGY OF THE EASTERN HALF OF KENT QUADRANGLE, CULBERSON, REEVES, AND JEFF DAVIS COUNTIES, TEXAS, by John P. Brand and Ronald K. DeFord. Map with text. November 1962 \$1.00

Study of Permian, Cretaceous, and Cenozoic rocks in the 30' Kent quadrangle is important to an understanding of the geology of Trans-Pecos Texas. This quadrangle is one of the critical areas in determining stratigraphic relations between central Texas to the east and the geosyncline in Mexico to the west and southwest. The detailed map is on a scale of 1:63,360 and is in color; a cross section is also included. Four major

physiographic features discussed are the Davis Mountains front, the southeastern end of the Apache Mountains, a part of the Toyah basin, and the Rustler Hills. Stratigraphic units include Seven Rivers Limestone, Yates Formation, Tansill Limestone of the Guadalupian Series; Castile Gypsum, Rustler Limestone, Pierce Canyon Formation of the Ochoan Series; Yearwood Formation, Cox Sandstone, Finlay Limestone, Buda Limestone, and Boquillas Limestone of the Cretaceous System. Mineral resources are also discussed in the text.

Mineral Resource Circular No. 43. RECONNAISSANCE OF TRACE ELEMENTS IN TEXAS COAL AND LIGNITE, by Donald W. Kohls, October 1962 Free on request

This report, made in cooperation with the U. S. Bureau of Mines, presents spectrochemical data on concentrations of trace elements in Texas coals and lignites and includes general information on location, stratigraphy, and reserves.

Mineral Resource Circular No. 44. THE MINERAL INDUSTRY OF TEXAS IN 1961, by F. F. Netzeband, Thomas R. Early, and Roselle M. Girard. Dec. 1962 Free on request

This annual publication, which is a preprint from the U. S. Bureau of Mines *Minerals Yearbook*, contains information on the quantity and value of mineral production in the State during the year.



Beryllium prospect in the Quitman Mountains, Hudspeth County, Texas. January 1962.

Publications in Press in 1962

The following publications were in press at the close of 1962:

1. "Upper Cretaceous Ammonites from the Gulf Coast of the United States," by Keith P. Young, University of Texas Publication 6304. This monograph, containing 82 plates, in December was in page proof approved for printing. It should be available early in 1963.

2. "The Geologic Story of Longhorn Cavern," by William H. Matthews III, Guidebook No. 4. This publication, one of the Bureau's non-technical Guidebook series, was in galley proof late in December.

3. "Pleistocene Geology of Red River Basin in

Texas," by John C. Frye and A. Byron Leonard, Report of Investigations No. 49. This report, in page proof in late December, is expected to be available in January of 1963.

4. "Index to Areal Geologic Maps in Texas, 1891-1961," by Thomas E. Brown. This map, the first product of the Texas Geologic Atlas Project, will be available early in 1963.

5. "Texas Rocks and Minerals: An Amateur's Guide," by Roselle M. Girard, Guidebook No. 6. This report was sent to the press in the latter part of December 1962.



Susquehanna-Western, Incorporated's, Mabel New uranium mine in Live Oak County, Texas. August 1962.

Publications by Bureau of Economic Geology Staff In Scientific Journals

- Barnes, V. E. (1962) Letters: *Scientific American*, vol. 206, no. 2, p. 12.
- Barnes, V. E. (1962) Temperature of tektite formation (abst.): *Jour. Amer. Geophys. Union*, vol. 67, no. 9, p. 3540.
- Barnes, V. E. (1962) Tektites: *I. C. S. U. Review*, vol. 4, pp. 75-81.
- Barnes, V. E. (1962) A world-wide geological investigation of tektites: *Lapidary Jour.*, vol. 16, no. 1, pp. 132-138. (Reprinted from *GeoTimes*, vol. 6, no. 4, pp. 8-12, 38, 1961, with addition of two pages of tektite and impactite photographs.)
- Barnes, V. E. (1962) On the origin of tektites: *Gems & Minerals*, no. 299, pp. 16-21, August. (Reprinted with modifications and additional tektite photographs from *Scientific American*, vol. 205, no. 5, pp. 58-65, 1961.)
- Barnes, V. E. (1962) Tektites—Original surfaces preserved beneath flanges, rayed bubbles and reoriented strain: *Trans. Amer. Geophys. Union*, vol. 43, p. 466.
- Barnes, V. E. (with Bell, W. C., Clabaugh, S. E., Cloud, P. E., Jr., McGehee, R. V., and Young, Keith) (1962) Field Excursion No. 1, November 10-11, 1962, Geology of Llano region and Anstin area, in *Geology of the Gulf Coast and Central Texas and Guidebook of Excursions for the 1962 Annual Meeting of The Geological Society of America*, pp. 58-131, Houston Geological Society, Houston, Texas.
- Barnes, V. E. (with Cloud, P. E., Jr.) (1962) Ordovician to earliest Mississippian rocks, Llano region, in *Geology of the Gulf Coast and Central Texas and Guidebook of Excursions for the 1962 Annual Meeting of the Geological Society of America*, pp. 86-93, Houston Geological Society, Houston, Texas.
- Barnes, V. E. (with Pitakpaivan, Kaset) (1962) Origin of Muong Nong-type tektites (abst.): *Jour. Amer. Geophys. Union*, vol. 67, no. 9, p. 3587.
- Barnes, V. E. (with Pitakpaivan, Kaset) (1962) Origin of indochinite tektites: *Proc. Nat. Acad. Sciences*, vol. 48, no. 6, pp. 947-955.
- Barnes, V. E. (with Bell, W. C.) (1962) Cambrian history, Llano region, in *Geology of the Gulf Coast and Central Texas and Guidebook of Excursions for the 1962 Annual Meeting of the Geological Society of America*, pp. 79-85, Houston Geological Society, Houston, Texas.
- Barnes, V. E. (with Bell, W. C., and Cloud, P. E., Jr.) (1962) Field trip road log, Stops 3 to 5, in *Geology of the Gulf Coast and Central Texas and Guidebook of Excursions for the 1962 Annual Meeting of the Geological Society of America*, pp. 113-124, Houston Geological Society, Houston, Texas.
- Fisher, W. L. (1962) Formation boundaries in the western Grand Canyon area (abst.): *Geol. Soc. America, Program 1962 Annual Meetings*, p. 53A.
- Fisher, W. L., and Rodda, P. U. (1962) *Athleta petrosa* stock from the Eocene of Texas (abst.): *Geol. Soc. America, Spec. Paper No. 68*, p. 177.
- Fisher, W. L. (with Sorauf, J. E.) (1962) Correlation chart of the Permian formations of North America: Discussion of the Grand Canyon section: *Bull. Geol. Soc. America*, vol. 73, pp. 649-652.
- Flawn, P. T. (with Wasserburg, G. J., Wetherill, G. A., and Silver, L. T.) (1962) A study of the ages of the Precambrian of Texas: *Jour. Geophys. Res.*, vol. 67, pp. 4021-4048.
- Owen, D. E. (1962) Gradational boundaries of the Dakota Sandstone in the southern San Juan Basin, New Mexico (abst.): *Geol. Soc. America, Program 1962 Annual Meetings*, p. 112.
- Owen, D. E. (with Angino, F. E.) (1962) Sedimentologic study of two members of the Beacon Formation, Windy Gully, Victoria Land, Antarctica: *Kansas Acad. Sci., Trans.*, vol. 65, pp. 61-69.
- Rodda, P. U., Dietrich, J. W., and Fisher, W. L. (1962) Quantitative study of *Athleta petrosa* stock in Eocene of Texas (abst.): *Bull. Amer. Assoc. Petrol. Geol.*, vol. 46, p. 276.
- Rodda, P. U., and Fisher, W. L. (1962) Late Paleozoic acrothoracic barnacles from Texas (abst.): *Geol. Soc. America, Program 1962 Annual Meetings*, pp. 125A-126A.
- Rodda, P. U. (with King, E. A., Jr.) (1962) Fused rocks in the Jackson Group (Eocene), Texas: *Gulf Coast Assoc. Geol. Soes., Trans.*, vol. 12, pp. 265-270.

Status of Current Projects

1. The Bureau will publish as a guidebook a series of papers prepared in connection with a field trip organized by Dr. Virgil E. Barnes for the 1962 meetings of The Geological Society of America in Houston. The guidebook will describe the geology of central Texas and include papers on Precambrian rocks by S. E. Clabaugh and R. V. McGehee, Cambrian rocks by W. C. Bell and V. E. Barnes, Ordovician to Mississippian rocks by V. E. Barnes and P. E. Cloud, Jr., Carboniferous rocks by W. C. Bell, and Cretaceous rocks by Keith P. Young.
2. A report on the study of possible commercial industrial sand deposits in Cambrian rocks of central Texas, by Virgil E. Barnes and Daniel A. Schofield, is scheduled for publication during 1963.
3. Geologic quadrangle mapping of Blanco County was mostly completed a number of years ago by Virgil E. Barnes. Recently, the U. S. Geological Survey issued 7½-minute topographic maps for the Johnson City and Rocky Creek quadrangles. Geologic maps of these quadrangles are being compiled, using the U. S. Geological Survey topographic maps as a base. It is hoped that both quadrangles will be published during 1963. The remaining nine quadrangles will be published as soon as texts are completed and base maps become available.
4. Manuscript for the volume on Cambrian and immediately overlying Ordovician rocks in central Texas, by V. E. Barnes and W. C. Bell, is complete except for sections on systematic paleontology, paleontography, paleoecology, and regional correlation. A series of faunal studies of these rocks have been made by graduate students supervised by Bell. The last study, faunas in the vicinity of the Cambrian and Ordovician boundary, is nearing completion and will provide the data needed to complete the Cambrian volume.
5. A manuscript by W. L. Fisher, P. U. Rodda, and J. W. Dietrich reporting the results of a statistical study, using the CDC 1604 computer, of the Eocene gastropod *Athleta petrosa* in Texas, is in process of critical review.
6. Publication of results of a study, under the direction of Peter U. Rodda, of high-calcium limestone and silica sand along the outcrop of Comanchean rocks from the Red River to the Rio Grande is still held up awaiting completion of analyses and testing of samples. Work should be complete in 1963.
7. Manuscript for "Geology of Big Bend National Park," by Ross A. Maxwell, John T. Lonsdale, John A. Wilson, and Roy T. Hazzard, is in process of critical review.
8. Investigation of the "sand-kaolin" belt between the Brazos and Trinity Rivers is under the direction of D. W. Kohls. The belt is being mapped and studies are in progress of the petrology, mineralogy, and chemistry of the rocks.
9. Mapping and correlation of volcanic rocks northward from Big Bend National Park into the Bofecillos Mountains of southern Presidio County, by John W. Dietrich, is still in progress. Mapping of the Ocotillo, Ochoa, and Presidio quadrangles in the same region is also in progress.
10. The geologic map of the Eagle Mountains in Trans-Pecos Texas, by James R. Underwood, is complete and is awaiting final copy of the accompanying text.
11. A study of phosphate nodules in Gulfian and Midway strata of the Texas Gulf Coastal Plain has been initiated by Don E. Owen.
12. A geologic map of the southeastern Llano uplift, Llano, Burnet, Blanco, and Gillespie counties, has been compiled by R. V. McGehee and is being prepared for release as a Bureau open-file geologic map.
13. The annual compilation of Texas mineral production statistics, by Roselle M. Girard, in cooperation with the U. S. Bureau of Mines, is in progress as a continuing project.
14. A new bibliography and index of Texas geology that will list papers published from 1951 through 1960 is being prepared by Roselle M. Girard. This will be the third in a series of bibliographies of Texas geology issued by the Bureau of Economic Geology. The earlier bibliographies are University of Texas Bulletin 3232, part 4, which lists papers published through 1932, and University of Texas Publication 5910, which lists papers published from 1933 through 1950.

Mineral Resources in East Texas Project

Area Redevelopment Administration Contract

In July of 1962 the Bureau negotiated with the Area Redevelopment Administration of the United States Department of Commerce, a \$40,000 contract for a mineral resource survey of 42 east Texas counties.

Although east Texas has been explored for oil and gas for many decades, few modern geological and engineering data have been developed on the other mineral deposits which occur in the area, with the exception of the iron ores, lignite (considered as fuel), salt, and sulfur. Relatively little is known about the other nonmetallic industrial minerals in east Texas which include clays, industrial sands, limestones, and construction materials. In addition to the well-known use of clays to make brick, tile, and other structural clay products, there are important industrial uses for adsorbent and bleaching clays, refractory clays, expanded clays, bonding clays, clays used as mineral fillers and pigments, catalysts, drilling muds, and as potential ores of aluminum. Lignites are potential chemical raw materials, sources of trace metals, and chelating agents. Industrial sands include abrasive sands, glass and chemical sands, metallurgical sands,

refractory sands (foundry sands), filter sands, and hydraulic fracturing sands. Limestones include cement, lime, aglime, fluxstone, crushed and dimension stone raw materials. Some sandstones in east Texas contain concentrations of titanium minerals and zircon; some rock units contain volcanic ash which might be used as abrasive material (pumicite) or as pozzolanic material. Construction materials include sand, gravel, aggregates, and dimension stone.

The nonmetallic industrial minerals have a low unit value and cannot move very far in trade due to transportation costs. However, they are consumed in large quantities by industry, and their development is a necessary accompaniment to industrialization. Furthermore, in our rapidly expanding and changing technology, new uses are being developed for nonmetallic materials particularly in the ceramic industries; mineral commodities that in the past have been of limited interest may suddenly acquire a new importance. Therefore, a complete and up-to-date mineral inventory of an area is a necessary part of any program for industrial development.



Dragline stripping at the Darco lignite mine of Atlas Chemical Industries, Inc., Harrison County, Texas.
September 1962.

Texas Geologic Atlas Project

The first year of the Texas Geologic Atlas Project was completed August 31, 1962. The first product of this project, now in press, is a new index to areal geologic maps in Texas (scale 1:1,200,000) which shows the areas of published geologic maps and unpublished theses in Texas. The map is accompanied by a text including a short introduction, a bibliography of areal geologic maps in Texas, and indexes to the maps by authors, counties, Army Map Service sheets (which serve as a base for the Atlas), and by regions for maps at scales smaller than 1:250,000.

Progress for the first year is summarized in the accompanying table. Those of the Army Map Service sheets for which geologic mapping is in progress are listed in column 1. The other four columns illustrate the manner in which the compilation is accomplished. Some companies (column 2) prefer to send their geologic mapping directly to the Bureau for compilation, others (columns 3, 4) undertake their own compilations, and some geological societies (column 5) have undertaken compilation of sheets in their region. The initial compiler is listed in column 3 and additional compilers are listed in column 4.

The date for the publication of the first Atlas sheet

cannot yet be predicted; however, work is well advanced on the Tyler, Palestine-Alexandria, Texarkana, McAllen-Brownsville, Laredo-Corpus Christi, Crystal City-Eagle Pass, and Van Horn-El Paso sheets.

For two weeks during August, Dr. John C. Frye and Dr. A. Byron Leonard gave the Atlas Project the benefit of their long experience with High Plains Quaternary deposits and mapped these deposits in portions of the San Angelo and Big Spring sheets. Dr. John P. Brand, Texas Technological College, spent the summer mapping in the Davis Mountains part of the Marfa and Fort Stockton sheets. Donald E. Owen of the Bureau has been field checking the Van Horn-El Paso sheet. In November, Dr. Barnes and contributing company geologists held a field conference in south Texas to resolve some Coastal Plain map problems.

The Oklahoma Geological Survey is cooperating in furnishing geological mapping for the Oklahoma portions of the Texarkana, Sherman, Perryton, and Dalhart sheets. The New Mexico Bureau of Mines and Mineral Resources is cooperating in completing mapping of the Dalhart, Tucumcari, Clovis, Brownfield, and Hobbs sheets. These sheets are about equally divided between New Mexico and Texas.

Well Sample and Core Library

During 1962, the Well Sample and Core Library received two large collections of electric logs. Shell Oil Company donated a library of 35,000 electric logs of wells in the Texas Gulf Coast region and Humble Oil & Refining Company gave 3,000 electric logs of wells in west Texas. Shell Oil Company also presented to the Bureau 300,000 samples of bit cuttings and cores from 5,000 wells in 120 counties in the Texas Coastal Plain.

In 1962, a low-cost warehouse was constructed to add an additional 3,000 square feet of storage space to the Library.

A new index of well samples and cores in the Bureau's Library is scheduled to go to press early in 1963.



New low-cost warehouses at the Well Sample and Core Library, Balcones Research Center.

Progress in Compiling Texas Geologic Atlas

Army Map Service Sheet	Geologic mapping sent directly to Bureau	Company making initial compilation of geologic mapping	Companies making additional compilations of geologic mapping	Societies or individuals compiling geologic mapping
Ahilene Alexandria	Southern Minerals Corp.	Humble Oil & Rfg. Co.* Humble Oil & Rfg. Co.	Shell Oil Co.	East Texas Geol. Soc. GAP Committee— A. C. Wright, Chm.
Big Spring Brownfield Brownsville Brownwood Clovis Corpus Christi Crystal City	Southern Minerals Corp. Southern Minerals Corp. Frith C. Owens	Humble Oil & Rfg. Co. Humble Oil & Rfg. Co. Amerada Petr. Corp.	Humble Oil & Rfg. Co. Mobil Oil Co.	John P. Brand* John P. Brand*
Del Rio ¹	Geophoto Services, Inc. Cities Service Petr. Co.	Amerada Petr. Corp. Shell Oil Co.		
Eagle Pass ¹ El Paso Emory Peak ¹ (Boquillas)	Geophoto Services, Inc. Cities Service Petr. Co. Mobil Oil Co.			
Fort Stockton	Geophoto Services, Inc. Cities Service Petr. Co. Mobil Oil Co.			
Laredo	Frith C. Owens	Humble Oil & Rfg. Co.	Shell Oil Co. Mobil Oil Co.	
Lubbock Marfa ¹	Cities Service Petr. Co. Continental Oil Co.	Humble Oil & Rfg. Co.*	Shell Oil Co.	John P. Brand*
McAllen	Frith C. Owens	Humble Oil & Rfg. Co.	Shell Oil Co. Mobil Oil Co.	
Palestine		Shell Oil Co.	Humble Oil & Rfg. Co. Pan American Petr. Corp. Mobil Oil Co.	East Texas Geol. Soc. GAP Committee— A. C. Wright, Chm.
Pecos Plainview Presidio San Angelo San Antonio	Cities Service Petr. Co. Continental Oil Co. Southern Minerals Corp.	Shell Oil Co. Amerada Petr. Corp.	Humble Oil & Rfg. Co.*	John P. Brand* South Texas Geol. Soc.* GAP Committee— Porter Montgomery, Chm.
Sherman Sonora	Geophoto Services, Inc. Cities Service Petr. Co.	Pure Oil Co.		
Texasarkana	Oklahoma Geol. Sur.	Shell Oil Co.	Humble Oil & Rfg. Co. Paul H. Nichols, Hudnall and Pirtle Pan American Petr. Corp.	East Texas Geol. Soc. GAP Committee— A. C. Wright, Chm.
Tyler		Shell Oil Co.	Humble Oil & Rfg. Co. R. W. Eaton, P. G. Lake, Inc. Pan American Petr. Corp. Mobil Oil Co.	East Texas Geol. Soc. GAP Committee— A. C. Wright, Chm.
Van Horn ²	P. B. King, U.S.G.S. Cities Service Petr. Co.	Shell Oil Co.		
Waco		Humble Oil & Rfg. Co. ³		

* In process of compilation.

¹ Sheet not yet published by U. S. Geological Survey; preliminary base material in Bureau file.

² Edgar Tobin Aerial Surveys furnished photo mosaics for portions of the Van Horn sheet.

³ Three districts are involved; geologic mapping from the Corpus Christi district has been received.

Mineral Studies Laboratory

In 1962 the name of the Mineral Technology Laboratory was changed to Mineral Studies Laboratory to reflect more clearly the nature of the laboratory's activities. This laboratory provides quantitative analytical data for Bureau staff projects, carries on continuing investigations of commercial uses for Texas minerals, and provides analytical and testing data as a public service.

During 1962 construction on new quarters for the laboratory continued; according to present plans they will be ready for occupancy in 1963. When complete, the new laboratory will have twice the present floor space and consist of analytical, spectrographic, mineral separation, and mineral processing sections.

The following items of new equipment were purchased in 1962:

- (1) Franz Isodynamic electromagnetic separator
- (2) Beckman Model DB spectrophotometer
- (3) Pitchford Selective-Uniform particle size grinder
- (4) Beckman Zeromatic pH meter
- (5) Cenco magnetic stirrer
- (6) Cenco constant-temperature oven
- (7) Braun jaw crusher

The new crushing and grinding equipment will reduce sample preparation time to about 1/10 that previously required.

Mr. S. K. Baijal, a chemist, joined the laboratory staff in 1962 to fill a new position.

New X-Ray Diffraction and Fluorescence Equipment

The Bureau of Economic Geology and the Department of Geology, by pooling equipment funds and with matching funds provided by The University of Texas, have purchased jointly a General Electric Model XRD 5 X-ray diffraction unit with fluorescence attachment. With this new instrument, the Bureau will be able to

expand its research in clay mineralogy and Texas clay mineral resources. The new equipment will be housed with existing Department of Geology X-ray equipment to create an X-ray laboratory with greater capacity for teaching and research.



Bennett-Clark Company's bentonite pit south of Zavalla, Angelina County, Texas. 1962.

National Science Foundation Grants in the Bureau of Economic Geology

The \$36,000 two-year grant for Research on Tektites which Dr. Virgil E. Barnes and Dr. F. Earl Ingerson, of the Department of Geology, received three years ago has been renewed for another two years from June 1. The remaining portion of this grant is for investigations in the Ivory Coast, to be concluded during 1963. In addition, a grant for \$30,000 has been received for continuation of "Research on Composition and Origin of Tektites." This grant is to be used to: (1) continue examination of tektite strewn-fields and impact features; (2) make additional chemical analyses; (3)

continue investigation of inclusions in tektites; (4) make solar furnace melting experiments; (5) continue examination of natural glasses and artificial glasses for properties they may have in common with tektites; (6) prepare manuscript on new findings and a final report.

During 1962, work continued under the National Science Foundation Grant of \$18,000 awarded to Peter T. Flawn and Earle F. McBride for study of igneous rocks in south Texas and northern Mexico. Graduate students completed mapping and sampling in south Texas; mapping is continuing in northern Mexico.

Bureau Will Occupy New Quarters in Will C. Hogg Building

In April of 1962 the Regents of The University of Texas announced approval of a new \$2,250,000 building, the Will C. Hogg Building, which will house the Department of Geology and the Bureau of Economic Geology. The building will be located on the new East Mall about one block west of San Jacinto Boulevard. Preliminary plans for the new building have already been drawn. The Bureau will occupy the top floor of the structure; the Bureau's Mineral Studies Laboratory, now moving into new enlarged quarters at Balcones Research Center, will stay at the Center. The Well Sample and Core Library, with its large space requirements, will also remain at the Center.

Housing of the Department of Geology and the

Bureau of Economic Geology in one building is enormously important to geology at The University of Texas. The two libraries will be merged to form the outstanding earth science library in the Southwest. The close association will permit greater exchange of ideas between faculty and Bureau staff. More efficient joint use of expensive equipment, such as the X-ray laboratory, will prevent duplication and result in higher return for research dollar spent. The special research interests of the Bureau staff will add depth to the Department's graduate program, and Department faculty on research leave in the Bureau will likewise enrich and diversify the Bureau's program.

Bureau Exhibit

The Bureau has prepared a new exhibit to illustrate its research and public service program at scientific meetings. Illustrative material is mounted on a series of specially lighted folding peg-board panels in such a way that it can be easily changed and brought up-to-date. The panels are versatile and easily transported. The exhibit was designed and built under the supervision of James W. Macon, the Bureau's Cartographer.

Bureau Employees Receive Merit Awards

At The University's second annual employee recognition program held December 20, 1962, two Bureau staff members received awards for long and meritorious service. Miss Josephine Casey was honored for 35 years service, and Daniel A. Schofield received recognition for 15 years service.

Staff Activities

Virgil E. Barnes, in addition to his duties as Associate Director, is directing the Geologic Atlas Project and is Director of Tektite Research. He attended two meetings of the American Geophysical Union, one in Washington where he presented papers on the temperature of tektite formation and the origin of Muong Nong-type tektites, and the other at Stanford where he gave a paper on unusual features in tektites. He also gave an address on tektites at the spring banquet of the University's chapter of Sigma Xi. In connection with the Geologic Atlas Project, Dr. Barnes called a field conference to discuss nomenclature and boundaries for Tertiary units. He also attended meetings of the American Association of Petroleum Geologists, San Francisco, and The Geological Society of America, Houston. In connection with the latter meeting, he was a leader of Field Trip No. 1 in central Texas. Following The Geological Society of America meeting, he attended the Frontiers of Geology Symposium held at Rice University. During 1962, Dr. Barnes continued writing on tektites, and articles were published in a number of technical journals. He has written a chapter entitled "Tektite Strewn-Fields" for the University of Chicago Press book on tektites, now in press.

John W. Dietrich has continued active in programming the Control Data Corporation Model 1604 digital computer installed at the Computation Center of The University of Texas. Programs have been written to plot scatter diagrams and cumulative curves from data collected for the *Athleta petrosa* project. He attended a short course, *Computer Applications in Geology*, conducted by Dr. W. C. Krumbein at The University of Texas in November. The basic statistical program written during the short course has been further developed to produce a flexible program for computing mean, standard deviation, variance, and linear correlation coefficients of 2 to 9 variables for a maximum of 500 samples. The program is modified by the computer to meet the requirements of each block of data.

Mr. Dietrich is co-author of a paper on the quantitative aspects of the *Athleta petrosa* project presented by Dr. Rodda before the San Francisco meeting of the American Association of Petroleum Geologists in March 1962. As a public-service activity, he has given talks to elementary school science classes.

W. L. Fisher attended the annual meetings of the Gulf Coast Association of Geological Societies in New

Orleans, The Geological Society of America in Houston, and the Texas Academy of Science in Austin. At Houston he gave a paper concerning formation boundaries in the western Grand Canyon of Arizona. Fisher also co-authored papers given at Houston and San Francisco by P. U. Rodda. During 1962 Fisher published, in the Bulletin of The Geological Society of America, a discussion of the Grand Canyon section of the Permian Correlation Chart. A paper with P. U. Rodda, describing Upper Paleozoic acrothoracic barnacles in Texas, is in press; manuscripts concerning evolution of the *Athleta petrosa* stock and Texas Coastal Plain lignites were completed. Fisher is directing the Bureau's two-year mineral resource study in east Texas and is working with P. U. Rodda on high-purity limestones in Texas.

During 1962, *Peter T. Flawn* attended meetings of the American Association of Petroleum Geologists in



Peter T. Flawn and friend in the Davis Mountains. August 1962.

San Francisco, American Association of State Geologists in Albany, New York, The Geological Society of America in Houston, and the Southwestern Federation of Geological Societies in Dallas. In addition, he made two trips to Mexico to supervise research in progress under a National Science Foundation grant. He visited the Quitman Mountains in Hudspeth County, Davis Mountains, Panhandle and South Plains, and east Texas in connection with current Bureau projects. In April, Dr. Flawn was in Houston for a meeting of the Directors of the Texas Coast Mining and Metal Section of the American Institute of Mining, Metallurgical, and Petroleum Engineers; in September he was in New York for the Policy and Administration Committee of The Geological Society of America.

Roselle M. Girard was active in providing mineral information in reply to queries from all over the State. In cooperation with the U. S. Bureau of Mines, Miss Girard helped prepare the Texas chapter of the *1961 Minerals Yearbook* and also *Texas Mineral Producers-1962*, a current listing of producers that is distributed by the Bureau. During the year she completed the manuscript "Texas Rocks and Minerals: An Amateur's Guide" and began work on a new bibliography and index of Texas geology. She also prepared reviews and press releases for several of the 1962 Bureau publications and continued her duties as acting librarian of the Bureau library.

Donald W. Kohls completed a reconnaissance study of the chemistry of Texas coal and lignite, which was published as Mineral Resource Circular No. 43. Dr. Kohls is presently conducting a study of the Wilcox "sand-kaolin" belt and associated sediments between the Brazos and Trinity Rivers. In March, he traveled to Georgia to study kaolin deposits and mining and processing methods. In December, he visited offices of Magcobar Corporation, Bauxite, Arkansas, to discuss the company's operations in east Texas. He attended The Geological Society of America meeting in Houston in November.

James W. Macon lectured to graduate students on photogeology using the Bureau's new Balplex plotter. He attended The Geological Society of America meeting in Houston where he was in charge of the Bureau's exhibit. During the year he worked on development of screens and patterns for color separations for the Texas Geologic Atlas Project and the Bureau's geologic quadrangle mapping program.

Ross A. Maxwell authored Report of Investigations No. 43, "Mineral Resources of South Texas: Region Served Through the Port of Corpus Christi," and a

memorial to the late John T. Lonsdale, which was published in The Geological Society of America Bulletin. He has recently completed a manuscript on the geology of Big Bend National Park. In November, Dr. Maxwell attended The Geological Society of America meeting in Houston, the conference for the Advancement of Science and Mathematics Teachers (CASMT) at The University of Texas, and the 66th Annual Meeting of the Texas Academy of Science at The University of Texas. He is currently preparing a non-technical report on Big Bend National Park. He is also engaged in the preparation of non-technical reports on selected State parks and geologic mapping of Cretaceous formations in eastern Brewster County. Dr. Maxwell continues to be active in public-service work as Bureau representative to the Board of Science Education of the Texas Academy of Science. He works with science classes in the Austin Public Schools and is a leader in the Boy Scouts of America organization, where he serves as counselor and committee member for Troop No. 11. He is a member of the Board of Directors for the Highland Lakes area of the Capitol Area Council. He is a member of Central Christian Church and is a Board member in that organization.

Philip S. Morey, geologist-in-charge of the Well Sample and Core Library, worked during the year to process the very large gift of well samples and electric logs from Shell Oil Company. He is also preparing a new index of well samples and cores.

Don E. Owen, who joined the Bureau staff in March, will complete requirements for a Ph.D. in geology from the University of Kansas in 1963. He is currently working with Dr. Barnes on the Texas Geologic Atlas project and is engaged in geologic mapping of parts of the Van Horn sheet, including the San Antonio Mountain and Tepee Butte quadrangles, and in photogeologic mapping of alluvial deposits on the Tyler sheet. Mr. Owen has also begun a study of the phosphate nodule beds that occur in Gulfian and Midway strata of the Texas Gulf Coastal Plain. He participated in the Sierra Diablo Field Conference of the Permian Basin Section of the Society of Economic Paleontologists and Mineralogists in April and in the Corpus Christi Geological Society coastal sedimentology field trip in June. Mr. Owen completed a short course in FORTRAN computer programming in the fall of 1962. He was co-author of a paper entitled "Sedimentologic Study of Two Members of the Beacon Formation, Windy Gully, Victoria Land, Antarctica," which appeared in the Spring Transactions of the Kansas Academy of Science. In Novem-

ber, he presented a paper entitled "Gradational Boundaries of the Dakota Sandstone in the Southern San Juan Basin, New Mexico," at the annual meeting of The Geological Society of America in Houston.

Peter U. Rodda presented a paper on quantitative studies of the evolution of the Eocene gastropod *Athleta petrosa* at the spring meeting of the American Association of Petroleum Geologists at San Francisco. In June he attended a field trip of the Corpus Christi Geological Society in south Texas. In November he presented a paper about fused rocks in the Jackson Group at the New Orleans meeting of the Gulf Coast Association of Geological Societies. Also in November he presented a paper on fossil barnacles at the Houston meeting of The Geological Society of America. This paper, co-authored by W. L. Fisher, will be published in the *Texas Journal of Science*. In December he attended the meeting of the Texas Academy of Science in Austin. Dr. Rodda is currently preparing a catalogue of type specimens in Bureau of Economic Geology collections

and working on stratigraphy of the Washita group in north Texas.

Daniel A. Schofield, chemist-in-charge of the Mineral Studies Laboratory, worked during 1962 with engineers of Balcones Research Center planning the new facilities now under construction. He also supervised installation of new equipment and set up analytical and testing procedures for the anticipated large volume of industrial mineral samples that are coming to the laboratory from the east Texas mineral resource study now in progress.

Cader A. Shelby spent most of the summer at the Institute of Marine Science in Port Aransas, where he divided his time between studies of heavy minerals on Mustang Island and the concentration of radioactive fallout in *Sargassum* along Texas beaches. In the fall of 1962 he was awarded the M.A. degree in geology. His study of heavy minerals in the Wellborn Formation will be published in 1963. He is currently engaged in public-service work and in field work in east Texas.



Ball clay underlying Carrizo Sandstone, General Refractories Company's clay pit near Troup, Cherokee County, Texas. 1962.

Texas Mineral Industry News

According to preliminary figures prepared jointly by the United States Bureau of Mines and the Bureau of Economic Geology, the value of Texas mineral production in 1962 was 4.3 billion dollars, up nearly 55.5 million dollars over 1961. Of the total value for 1962, 92% was petroleum, natural gas, and natural gas liquids, 7% was nonmetallic minerals (mostly cement, clays, gypsum, lime, sulfur, sand and gravel, salt, and stone) and the remaining 1% was metals and other miscellaneous commodities.

Mineral fuels showed an overall increase of 1%. However, whereas natural gas and natural gas liquids increased substantially, crude oil declined. In 1940 crude oil made up 71% of total value of mineral fuels, by 1956 it had declined to 53% of the total, and in 1962 it was only 44% of total value of mineral fuels.

Among the nonmetallic minerals, increases were shown by cement, gypsum, salt, stone, and talc. Helium and lime registered sharp gains, clays and sand and gravel remained more or less static, sulfur decreased slightly.

The big gains in nonmetallics were a reflection of the prosperous construction industry. Cement producing capacity increased 7% but only 62% of total capacity was utilized. Southwestern Portland Cement Company began construction of a 10-million dollar plant west of

Amarillo and also expanded its El Paso facilities. Gulf Coast Portland completed its Houston plant. Texas Industries announced plans to double capacity of the Midlothian plant. Quantity of lime consumed by the construction industry increased 76% while that consumed by the chemical industry increased 27%. Texas Gypsum Company plans a new half-million dollar wallboard plant at Irving. Athens Brick Company will build a new kiln at Athens. Acme Brick Company plans a new 70,000 brick-per-day plant in Denton County, and at Malakoff, Texas, Clay Tile began construction of a new plant to produce hollow building tile. This latter construction is partly financed through an Area Redevelopment Administration loan. The Texas granite industry was encouraged by plans for construction of new jetties along the Texas coast.

Helium showed the largest percentage increase. In 1961, production was valued at \$3,196,000; 1962 production was valued at \$8,761,000.

During 1962, developments in Trans-Pecos Texas were as follows: (1) TXL Oil Corporation was engaged in exploratory work in the old Allamoore copper-silver district. Prospecting by diamond drilling was carried on at the Sancho Panza, St. Elmo, Blackshaft, and Hackberry prospects. (2) Perlite Producers, Inc.,

opened a new 200-tpd crushing and screening plant at Marfa, to process perlite mined at the company's Pinto Canyon property southwest of Marfa. (3) The U. S. Bureau of Mines carried on exploratory work for beryllium in Trans-Pecos Texas. (4) Sierra Talc Company of California purchased properties of Florida Tile in the Hudspeth County talc district. (5) Texas Construction Material Company continued to develop their Marble Canyon marble property in Hudspeth County. Plans are to produce dimension stone and terrazzo chips. (6) Continental Minerals' new barite mill at Van Horn produced ground barite which was marketed under the name Delabar for use in manufacture of drilling mud. (7) Framspar, Inc., announced plans to construct a half-million dollar fluorspar flotation mill at Alpine to process Mexican ores.

Under the name Alto Sand Company, Pasadena Diesel Refining Company began a new operation to produce silica sand and industrial sand from a property 5 miles south of Alto in Cherokee County. The sand is pumped from the pit to a hydraulic classifier and dried in a rotary kiln.

Susquehanna-Western, Inc., developed its Mabel New uranium mine in Live Oak County; ore shipments to the Falls City mill began in May of 1962.



Open-pit mining of massive barite, Continental Minerals' mine, Culberson County, Texas.

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Administrative Assistant

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