STRATIGRAPHY, SEDIMENTOLOGY, AND URANIUM POTENTIAL OF VIRGILIAN THROUGH LEONARDIAN STRATA IN WESTERN MARIETTA BASIN AND CENTRAL MUENSTER-WAURIKA ARCH, OKLAHOMA AND TEXAS

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PREFACE

This thesis concerns the distribution and petrology of selected facies of Upper Pennsylvanian and Lower Permian rocks in south-central Oklahoma and north-central Texas. Electric and radioactivity logs were used to prepare maps and several stratigraphic cross-sections. Analyses of cores and cross-sections were used to make inferences about depositional environments. Conclusions as to the uranium potential of the area were made based on the above information.

I would like to express my sincere gratitude to Dr. Gary F. Stewart, thesis adviser, for his professional guidance and assistance during this study. Special recognition is directed to Dr. John D. Naff and Dr. Zuhair Al-Shaieb, advisory committee members, for their helpful suggestions, comments, and criticisms. Dr. John W. Shelton, Dr. R. Nowell Donovan, and Dr. Richard Thomas are gratefully acknowledged for their assistance in the description of cores. Suggestions and constructive criticisms of fellow graduate students, specifically Bryan E. Lee, are greatly appreciated.

Information and material for this study were obtained from several sources: Mrs. Louise Voigt, manager of the Oklahoma Well Log Library at Tulsa, provided access to borehole well logs; Raoul Soleis, Texas Brueau of Economic Geology, provided electric logs and data on correlation of strata in North Texas; Ben G. Herb, Well Sample and Core Library, University of Texas at Austin, provided well bit-cuttings; and the Oklahoma Geological Survey provided cores.

Partial financial support was provided by Dr. John W. Shelton for the preparation of thin sections and through Bendix Field Engineering Corporation contract 78-131-E. Special thanks is given to my mother, Mrs. Jo Anne Bowker, for her financial and moral support throughout my academic career. Finally, I would like to dedicate this study to my friend, Nancy Oldis, in acknowledgment of her valued contributions.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

CHAPTER I

ABSTRACT

The distribution of Virgilian through Leonardian depositional systems indicate a pattern of basin filling and overall marine regression. Depositional environments ranged from shallow marine to alluvial plain.

Sedimentation was influenced by structural geology. The Wichita Mountains, the Red River Arch, and possibly the Ouachita Folded Belt, all products of Paleozoic tectonism, were the primary sources of clastic material.

Diagenetic events include lithification of the sands and subsequent dissolution of the calcite cement, which formed secondary porosity.

Several factors indicate that conditions may have been favorable for uranium mineralization: occurrences of radioactive rocks at the surface, radioactivity logs that show uncommonly high levels of gamma-radiation in some strata, abundant arkosic sandstones and conglomerates, abundance of carbonaceous material in the rocks, presence of faults, nearby oil production, and proximity of an uranium-ion source, the Wichita Granite.

CHAPTER II

INTRODUCTION

Location of Study Area

The study area, approximately 875 square miles, includes part of Cotton, Comanche, Jefferson and Stephens Counties, Oklahoma, and Clay County, Texas (Fig. 1). Virgilian through Leonardian strata were studied (Plate 1). The area includes the extreme western portion of the Marietta Basin, and the central portions of the Red River and Waurika-Muenster Arches (Plate 2).

Statement of the Problem

The objective of this study was to find and delineate rock units of types believed to be likely host rock for uranium mineralization in the shallow subsurface (less than 5000 ft). To do this the following properties of the area had to be established:

1. stratigraphic relationships,
2. structural and tectonic framework,
3. depositional trends,
4. internal features of sedimentary units,
5. source area(s) of the sediments, and
6. major diagenetic events.

These geologic factors can be used to recognize 1) depositional

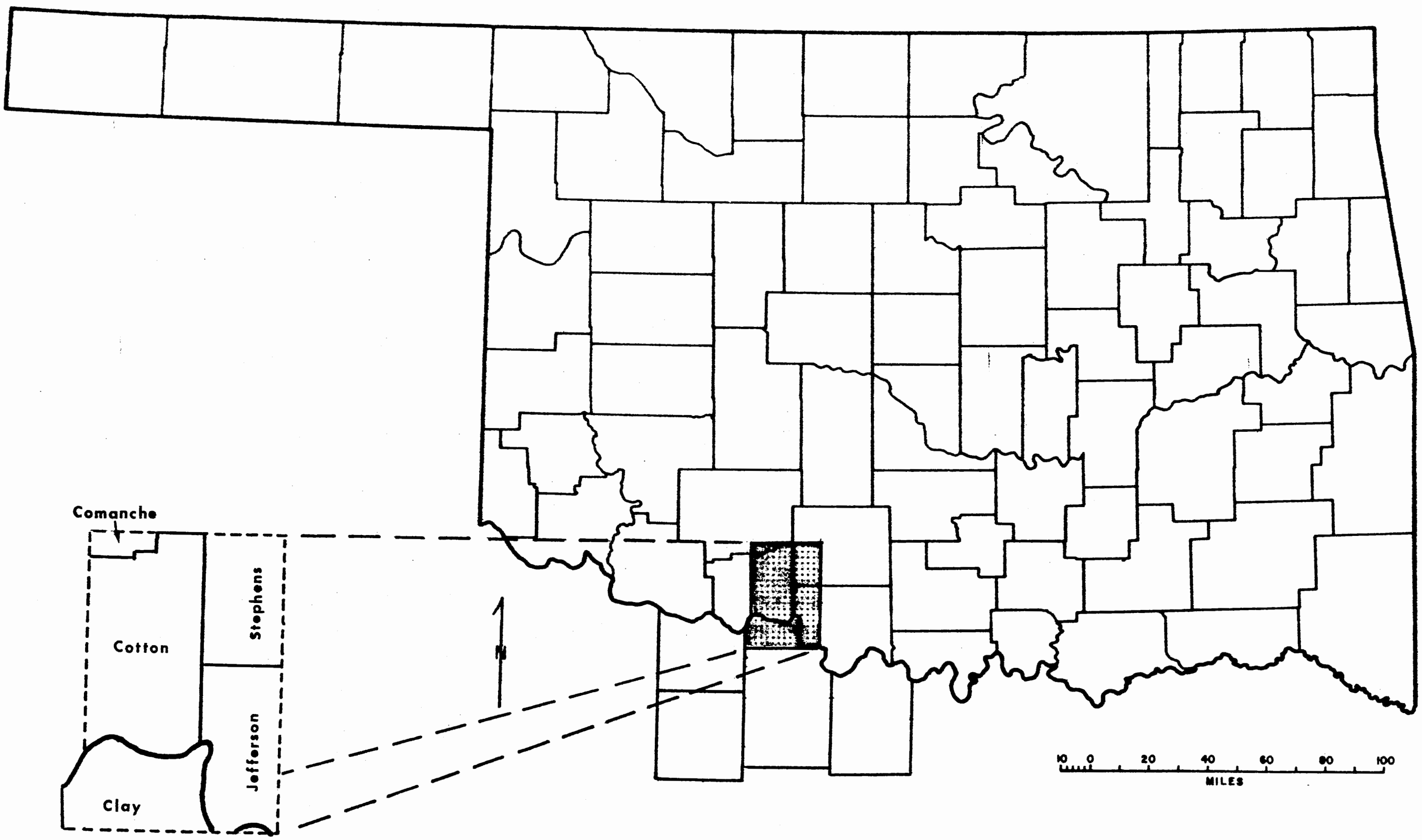


Fig. 1.-Location map of study area

environments and their distributions, 2) relations of structural geology to sedimentology and to mineralization, and 3) the effects of diagenesis on potential host rocks.

Previous Investigations

The Pennsylvanian and Permian strata of the Oklahoma portion of the study area were divided by the Oklahoma Geological Survey into the Oscar, Sumner, and Hennessey Groups (Havens, 1977). Cheney (1940), Brown (1962, 1969b), Brown and others (1973), Wermund and Jenkins (1969), and Erxleben (1974) classified, mapped, and interpreted depositional environments and facies trends in north-central Texas.

Much of the study area's subsurface is described in papers dealing with hydrocarbon exploration and production. Swigart (1919, 1920) was one of the first to describe selected sandstone units in the subsurface. Pate (1948), Cipriani (1956), McBee and Vaughan (1956), Putnam (1959), and Tomlinson and McBee (1959) described the subsurface geology of selected oil fields. Druitt (1957) described the subsurface geology of Jefferson County, Oklahoma.

Between 1951 and 1956 the U. S. Atomic Energy Commission (1968) located several radioactive anomalies in the study area. Chase (1954), and Olmsted (1975) described radioactive anomalies in the region. Al-Shaieb and others (1977a, 1977b) described the geology and radioactive anomalies in the Oklahoma portion of the project area; work by Morrision (1977) is included in these reports. Stanton and others (1977) dealt with surface and subsurface geology of the area and noted radioactive anomalies.

Methodology

Approximately 370 electric logs were correlated, and where well density was sufficient, one electric log per square mile was used. Seventeen looped correlation-sections were used as the framework in correlating. Three key cross-sections are in this report (Plates 3, 4, and 5). A stratigraphic cross-section also was made to show shelf-slope-basin relationships of the western Marietta Basin (Plate 6).

Regional structural geology is shown by a structural contour map of the top of the Megargel Limestone Member of the undivided Thrifty-Graham Formations (Plate 7). The Megargel Limestone Member is the youngest and most extensive marker in the area.

The stratigraphic section was divided into two major intervals and two subintervals (Plate 8). Net-sandstone maps were prepared for each interval and subinterval in order to determine depositional trends (Plates 9, 10, 11, and 12).

The available cores from wells in the area were studied to determine and describe the range of depositional environments (Appendix A). Bit cuttings from three wells in the Texas portion of the study area were described for comparison of lithology to electric-log characteristics (Appendix B).

Nineteen thin sections from selected cored intervals were the basis of descriptions of petrology and diagenesis. To facilitate the study of authigenic clays, several samples were analyzed with a scanning electron microscope.

Cores and bit-cuttings were tested with a scintillometer for unusal radioactivity. The available gamma-ray logs were surveyed to locate areas and rock units with anomalously high radioactivity.

Field work consisted of a scintillometer and gamma-ray spectrometer survey of the area. Samples of rock, soil, and stream sediment from the area were analyzed by atomic-absorption.

CHAPTER III

STRUCTURAL FRAMEWORK

General

The study area is bounded on the north by the west-northwest-trending Wichita-Criner Uplift. The Marietta Basin is included in the central portion of the area. The west-northwest-trending Waurika-Muenster Arch extends through the southern portion of the area. The Red River Arch bounds the study area on the south. Plate 2 shows the major tectonic elements in and around the study area.

Structural relief in the study area is believed to be related to Pennsylvanian and Permian sinistral strike-slip movement and relatively minor normal movement along Late Precambrian and Early Cambrian boundary faults (Ham, Denison, and Merritt, 1964; and Wickham, 1978). Locations of these faults might have been predetermined by Precambrian rifting (Powell and Phelps, 1977). The apparent strike-slip movement could have produced many en-echelon, northwest-trending paired basins and uplifts, such as the Wichita Mountains Uplift and Anadarko Basin, and the Muenster-Waurika Arch and Marietta Basin. This Late Paleozoic deformation, which occurred in three orogenic pulses (Ham and Wilson, 1967), is believed to be related to subduction of oceanic lithosphere and formation of the Ouachita Folded Belt (Walper, 1977). In the thesis area, maximal downwarp of the Marietta Basin relative to the Muenster-Waurika Arch was approximately 15,000 ft (Ham and others, 1964, plate 4).

The Red River Arch is an outstanding west-trending structure in the southern portion of the study area (Plate 2). Its origin has been speculated upon by Lee (1980), who outlined several mechanisms that could have produced the arch. Of these, two seem more probable.

1) The Red River Arch and other west-trending structures were caused by flexures in the continental plate. Walper (1977) proposed this mechanism for similar features in central Texas.

2) The arch is a subsurface expression of a Precambrian mobile belt. Deformation along this belt might have been similar to that in the Wichita trend (Flawn, 1956).

Al-Shaieb (personal communication) believes that the Red River Arch is a remnant of an older Precambrian aulacogen. Ham and Wilson (1967, p. 372) stated that the Wichita and Red River trends are genetically similar.

Structure of the Top of the Megargel Limestone Member

Shallow and intermediate subsurface structure is shown by a structural geologic map (Plate 3) of the top of the Megargel Limestone Member of the undivided Thrifty and Graham Formations. The Megargel Limestone is the youngest of the persistent marker beds in the area (Plate 1).

General trends of folds are northwesterly, except for the west-trending folds associated with the Red River Arch. Trends of minor and seemingly secondary folds are to the south and southwest. Two major syndepositional faults are mapped at the Megargel's stratigraphic position. Displacement along these faults diminishes near the surface; therefore they are considered to be growth faults (Morrison, 1977). The subsurface well log data (Appendix G) forces the placement of these shallow faults near the mapped positions of the Duncan-Criner and Waurika-Muenster basement faults (Ham and others, 1964, plate 2); therefore they probably are shallow expressions of these basement faults.

CHAPTER IV

STRATIGRAPHIC FRAMEWORK

Introduction

Many of the lithologic units found in the relatively stable Eastern Shelf of north-central Texas are not present in the more tectonically active Muenster-Waurika Arch and Marietta Basin areas of southern Oklahoma (Tomlinson and McBee, 1959). This discontinuity required the use of a combination of southern Oklahoma terminology (Pate, 1948; and Putman, 1956) and north-central Texas terminology (Brown, 1960; and Erxleben, 1974). Plate 1 is a correlation chart showing the stratigraphic names used in this study.

Formally, Virgilian through Leonardian strata are divided by the Oklahoma Geological Survey into the Vamoosa, Lecompton, Ada, Vanoss, Oscar, Sumner, and Hennessey Groups (Havens, 1977). The Texas Bureau of Economic Geology has divided the section into the Cisco, Wichita-Albany, and Clear Fork Groups (Stanton, 1977). The Hoxbar Group of Oklahoma and the Canyon Group of Texas are both Missourian and are equivalent (Stanton, 1977, p. 5).

Key marker beds used in the correlation framework are taken from the work of 1) The Texas Bureau of Economic Geology (Brown, 1962, 1969a, 1969b, 1972; Brown and others, 1973; Galloway and Brown, 1972, 1973; Erxleben, 1974; and Soleis, 1980), 2) Druitt (1957), and 3) the Oklahoma

Geological Survey's Guidebook VI (Jordan, 1957).

Type electric logs are shown in Plate 8; their locations are shown in Figure 2. Wide ranges in facies and thickness across the study area are shown by the type logs. The type logs also demonstrate the difficulty in determining the Pennsylvanian-Permian systemic boundary, and Virgilian, Wolfcampian and Leonardian stage boundaries. This difficulty is caused by gradational changes in depositional systems, near-constant clastic sedimentation, and growth faulting during the Pennsylvanian and Permian Periods (Morrison, 1977). However, the divisions shown in Plate 8 frequently are used as boundaries.

Correlation Sections

Two east-west correlation sections (Plates 3 and 4) and a north-south correlation section (Plate 5) are included to illustrate typical lateral and vertical faces changes. Locations of the correlation sections are shown in Figure 2.

The stratigraphic section was divided into two major intervals and two subintervals. In ascending order, the marker beds used to define these intervals are the Home Creek Limestone Member of the Caddo Creek Formation or its equivalent, the "twin lime" zone of the Hoxbar Group, the Armstrong Limestone Member, the Megargel Limestone Member, and the Fusulinid Limestone Member of the undivided Thrifty and Graham Formations (Plate 1). Problems caused by lack of extensive marker beds above the Fusulinid Limestone and between the Armstrong Limestone and Home Creek Limestone made subdivision of these portions of the stratigraphic section impractical. However, *ad hoc* markers were used in an attempt to correlate the section above the Fusulinid Limestone, and between the Armstrong

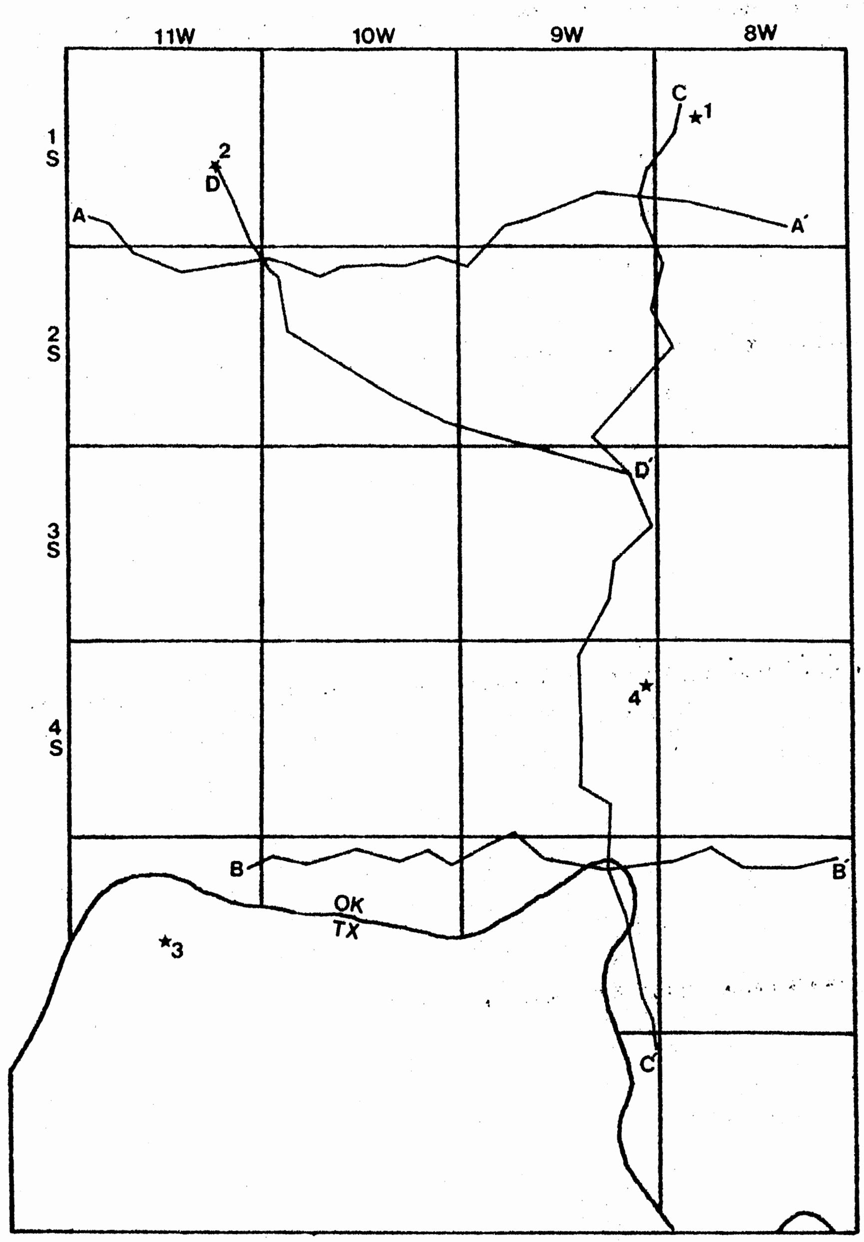


Fig. 2.-Location map of cross sections and type logs

Limestone and Home Creek Limestone.

Sandstone-percentage Maps

Sandstone-percentage maps of the two major intervals and two subintervals were made to estimate depositional trends and to determine if structural geology influenced deposition. Possible source areas might also be determined from sandstone percentage maps. Alternatives to sandstone percentage maps, i.e. net and gross-sandstone thickness maps, were not prepared because of large variations in thicknesses of the intervals. For example, the measurable thickness of Interval 2 (the upper interval) depends upon the depths of erosion and the depths of surface well casing. The table showing total-interval thickness, net sandstone, and sandstone percentages for each well location is in Appendix G.

Interval 1

Interval 1 is defined as the interval between the top of the Home Creek Limestone and the top of the Megargel Limestone (Plates 1 and 8). Net-sandstone thickness in this interval ranges from 28 to 688 ft. Percentage of sandstone ranges from 5 to 77 percent.

Sandstone percentages of Interval 1 (Plate 9) do not indicate specific source areas, but comparison with the structural geologic map (Plate 7) shows that geologic structure could have influenced deposition. Areas of high sandstone percentage are located on the down-thrown side of the Duncan-Criner fault mapped in the northeastern corner of the study area. The northern flank of the Red River Arch, which is included in the extreme southern portion of the study area, is another locality of thick sandstone, as is the deeper part of the Marietta Basin. Extensive low-sandstone-percentage areas are in the structurally high northwestern and south-central portions of the study area. These are also areas of relatively high carbonate percentages (Plate 6), suggesting an inverse relationship between carbonate and sand deposition.

Interval 1A

Interval 1A extends from the top of the Armstrong Limestone Member to the top of the Megargel Limestone Member (Plates 1 and 8). The sandstone-percentage map of this interval (Plate 10) approximates an isopach map of the Zypsie and Keys Sandstone Members since the interval thickness is nearly constant (mean = 193.6 ft, standard deviation = 19.8 ft, Appendix G). This thinner interval should show depositional trends in more detail since fewer sandstone units are included. The net sandstone thickness ranges from 0 to 155 ft and the sandstone percentage ranges from 0 to 87 percent.

Sandstone deposition seems to have been associated with structural geology, as probably was the case with Interval 1. However there are some major differences; in Interval 1A there is not an extensive sandstone accumulation within the deeper Marietta Basin; also, areas of high sandstone percentage are located on the downthrown side of the northwest-trending Waurika-Muenster fault located in the southwest section of the region.

The thick sandstone wedge associated with the Red River Arch in Interval 1 is not present in Interval 1A. This could represent the decline of the Red River Arch as a major source of clastic sediment.

Interval 2

Interval 2 extends from the top of the Megargel Limestone Member to the surface (Plates 1 and 8). Net sandstone thickness ranges from 44 to

860 ft. Sandstone percentage ranges from 2 to 31 percent.

Sandstone distribution in Interval 2 shows few distinctive trends (Plate 11). The structurally high northwestern section of the area continued to be a location of slight sandstone accumulation. In the remaining part of the area sandstone percentages range from 15 to 31 percent. Comparison of Plates 7 and 11 indicates that structural geology probably was less influential upon the deposition of the sediments contained in Interval 2 than upon older sediments included in this study.

Interval 2A

Interval 2A is defined as strata between the top of the Megargel Limestone Member and the top of the Fusulinid Limestone Member (Plates 1 and 8). Thickness of net sandstone ranges from 0 to 134 ft. Sandstone percentage ranges from 0 to 85 percent.

Sandstone percentage trends of Interval 2A (Plate 12) are poorly defined and are not strong evidence about source region(s). Areas of thick sandstone circumscribe the deeper portion of the Marietta Basin (Plate 7). The northwesternmost part of the area contains somewhat less sand than other parts of the area.

CHAPTER V

SEDIMENTOLOGY

Introduction

Inferences made in this chapter concerning sedimentary processes and depositional environments are based on cross sections, electric-log characteristics, sandstone-percentage maps, and analyses of cores and bit-cuttings. Many of the interpretations made were guided by criteria set out by Shelton (1973). Descriptions of similar Virgilian rocks in north-central Texas by Brown (1969a, 1969b and 1972), and Brown and others (1973) were consulted frequently.

Depositional Systems

The western Marietta Basin and surrounding areas were the locations of an overall marine regression during the Pennsylvanian and Permian Periods. Missourian shelf-carbonates and clastics (Appendix A; and Erxleben, 1974) gave way, in early and middle Virgilian time, to deltaic and associated facies. Upper Virgilian and lower Wolfcampian sediments reflect fluvial deposition.

In early and middle Virgilian times the regressive sequence in the area was interrupted at least three times by widespread marine transgression. The Armstrong, Megargel and Fusulinid Limestone Members (Plate 1) were deposited during these shallow-water transgressions. Several other thin, less extensive limestones exist in the middle Virgilian section, especially in the northwesternmost part of the area (Plates 6 and 8). These minor limestone units could reflect local deltaic subsidence and transgression onto the ancient shelf (Brown, 1969b and 1972).

Analyses of cores (Appendix A) and bit-cuttings (Appendix B), and work by Erxleben (1974), Morrison (1977) and Robberson (1980) all give strong indications of a major source area in the Wichita Mountains (Plate 2). Sandstone-percentage maps discussed in Chapter IV are insufficient for identification of a major source area. The above workers also believe that the Red River Arch (Plate 2) could have been an intermittent source of sediments. The sandstone-percentage map of Interval 1 (Plate 9) shows that the arch could have supplied sediment at least during early Virgilian time. Morrison (1977) indicated that the Ouachita Folded Belt (Plate 2) probably was also a sediment source, but I found no strong evidence to support his belief.

Much of the study area was tectonically unstable during most of the Pennsylvanian (Ham and others, 1964). Evidence of Pennsylvanian growth faulting (Morrison, 1977) and abundance of course clastics throughout the system support this conclusion. Relatively high concentrations of sandstone around faulted areas indicate that fault "scarps" might have supplied sediment, at least during early Virgilian time (cf. Plate 7 with Plates 9 and 10).

Interval 1

Rocks in Interval 1 (Plates 1 and 8) are evidence of the general regression that occurred during early Virgilian time. The Missourian Home Creek Limestone Member and time-equivalent sandstone units, which reflect shelf-carbonate and fan-delta deposition (Erxleben, 1974), are overlain by as much as 400 ft of shale in most of the area. Thick sandstones overlie the Home Creek Limestone interval in the northeastern section of the area (Plates 8 and 9). These lower Virgilian clastics are assigned to the Finis and Necessity Shale Members (Plate 1). Robberson (1980, p. 17) described the Finis Shale as containing fenestrate bryozans and brachiopods, indicating marine deposition. The black to gray Necessity Shale (Plates 14 and 15) probably is marine also. The thick sandstones units might have been deposited in fan-delta complexes comparable to those described by Erxleben (1974). In the northwesternmost part of the area a section of interbedded thin limestones and shales, which correlate with the Finis and Necessity Shale Members (Plate 8), probably were deposited on the early Virgilian shelf of the Marietta Basin. Lee (1980) proposed the same depositional environment for limestones of equivalent age in the Hollis-Hardeman Basin of western Oklahoma.

The remaining part of the interval is made up of sandstones, limestones and interbedded shales (Plate 8). Individual sandstone units are not extensive (Plates 3 through 6) and therefore are thought to have been deposited in channels. The association of sandstones with the transgressive Armstrong Limestone Member (Plates 1 and 8) suggests that the sandstones were deposited in a paralic environment.

Interval 2

After deposition of the Megargel Limestone Member (Plate 1), which records the most extensive transgression in Virgilian time, the overall regressive process continued.

In the lower part of Interval 2, defined as Subinterval 2A (Plate 8), sandstone is abundant (Plate 12). Analysis of cores of the Priddy

Sandstone Member, which is included in Subinterval 2A (Plate 8), shows that the sand probably was deposited in an alluvial plain (Appendix A). The fossiliferous Fusulinid Limestone Member (Plate 1) and several other thinner, less extensive limestones mark transgressive periods during middle Virgilian time. Strata in much of the remaining part of Interval 2 probably also were deposited in an alluvial plain environment, as shown by the composition and red color of the rock (Plates 13, 14 and 15), and by lack of laterally extensive strata (Plates 3 through 6).

CHAPTER VI

DIAGENESIS

Introduction

Petrographic-microscopic study of thin sections and scanning-electron-microscope (SEM) study of selected samples were used to determine the diagenetic events that affected Virgilian sandstones. Diagenesis is a strong factor in the destruction and formation of porosity and permeability in sandstone. Of course, good porosity and permeability are essential if fluids are to move through potential reservoir rock.

The diagenetic study was performed on various sandstone types; including lithic subarkoses and quartarenites. Arkosic sandstones, the type thought to be most conducive to uranium mineralization (Al-Shaieb and others, 1977b), contain varying amounts of quartz, microcline, oligoclase, garnet, zircon, muscovite, carbonized wood, leucoxene, and tourmaline. Appendix A contains more detailed lithologic descriptions of each of the sandstone units.

Diagenetic Phases

Several diagenetic events can be shown to have occurred in the sandstones studied. These events are grouped into three phases and will be discussed chronologically. Because the samples considered here are sparse, the diagenetic events recorded may not be representative of the entire study area.

Early-phase Diagenesis

Pyrite was precipitated locally among detrital grains and was subsequently oxidized to hematite (Fig. 3). Formation of these pyrite veins might have preceded formation of syntaxial quartz overgrowths. Locally these overgrowths form an interlocking texture; they may have destroyed the primary porosity of the sandstones.

Middle-phase Diagenesis

Extensive corrosion and replacement of quartz overgrowths and detrital grains by poikilitic carbonate cement occurred in the second phase (Figs. 4 and 5). The early-formed pyrite-hematite veins also were attacked by the carbonate. Ferroan calcite and minor ferroan dolomite are the carbonate minerals.

Late-phase Diagenesis

Partial dissolution of middle-phase carbonates formed secondary porosity (averaging 15%) in the sandstones during late-phase diagenesis. Secondary porosity is recognized by oversized and elongated pores, floating grains, and partial dissolution of carbonate cement (Fig. 6).

Authigenic chlorite, mixed-layer clay (probably a mixed-layer illite), and kaolinite were precipitated in pores and pore throats (Figs. 7 and 8). Kaolinite also replaced feldspar, resulting in microporosity in the area of replacement (Fig. 9). Locally, clay replaced carbonate cement. Chert and chalcedony are minor authigenic constituents.

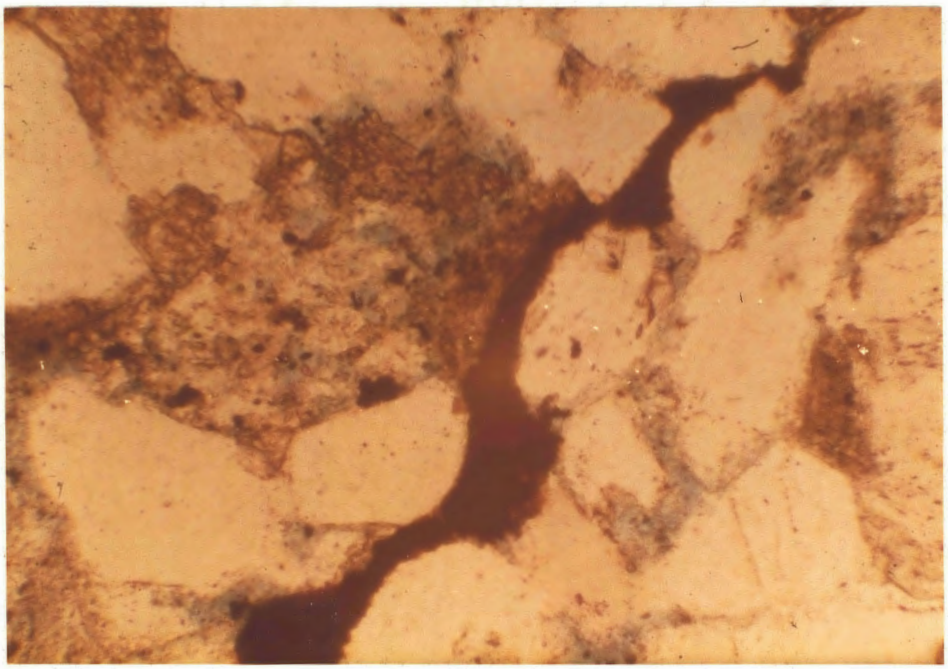


Fig. 3.-Opaque pyrite vein precipitated during early-phase diagenesis and subsequently oxidized to hematite; from Perkins Production Co., Records No. 1, depth 2144 ft (plane polarized, X100)

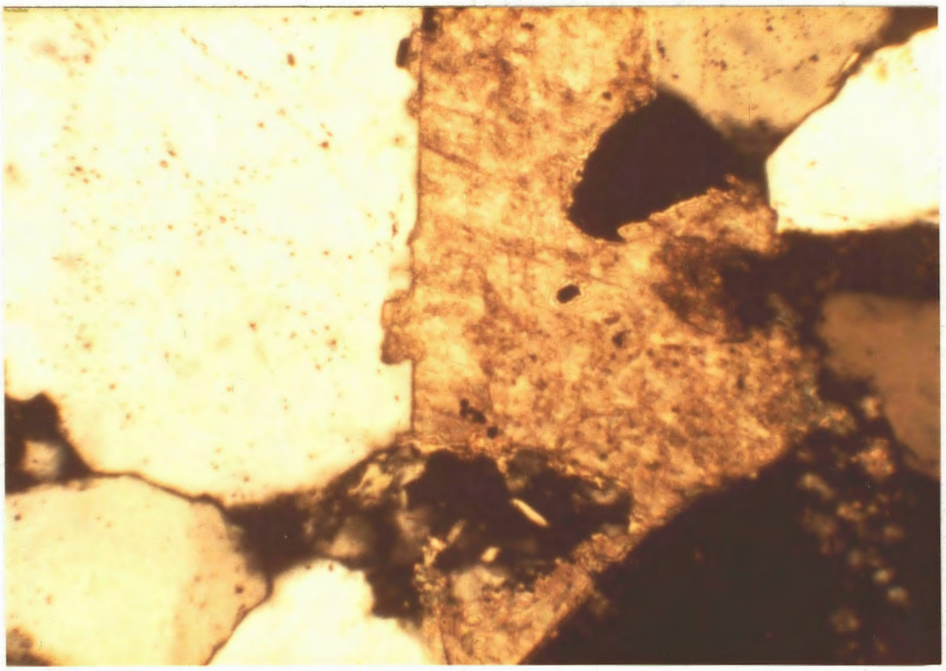


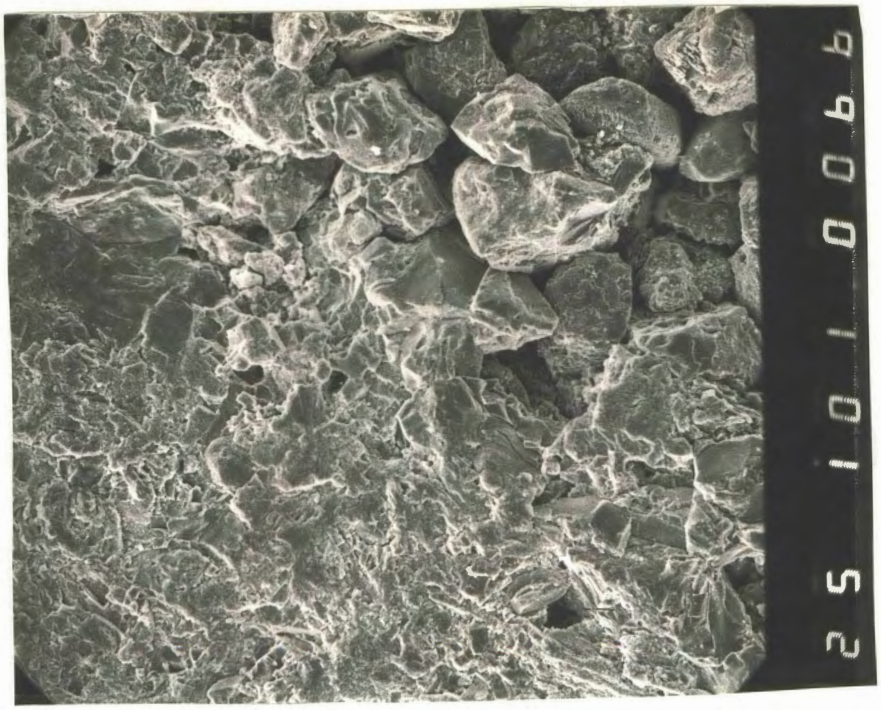
Fig. 4.-Calcite cement (amber, high birefringence) that replaced overgrown quartz grains; from Perkins Production Co., Records No. 1, depth 2137 ft (crossed polars, X100)

A)

B)

Fig. 5.-Corrosion of detrital grains. A) Overview of leached sandstone (SEM, X200). B) Close-up of plagioclase grain in center of photograph (A), notice preferential dissolution along twin laminae (SEM, X2000); both from Cities Service Co., Cantrell No. 22, depth 2258 ft

A)



B)

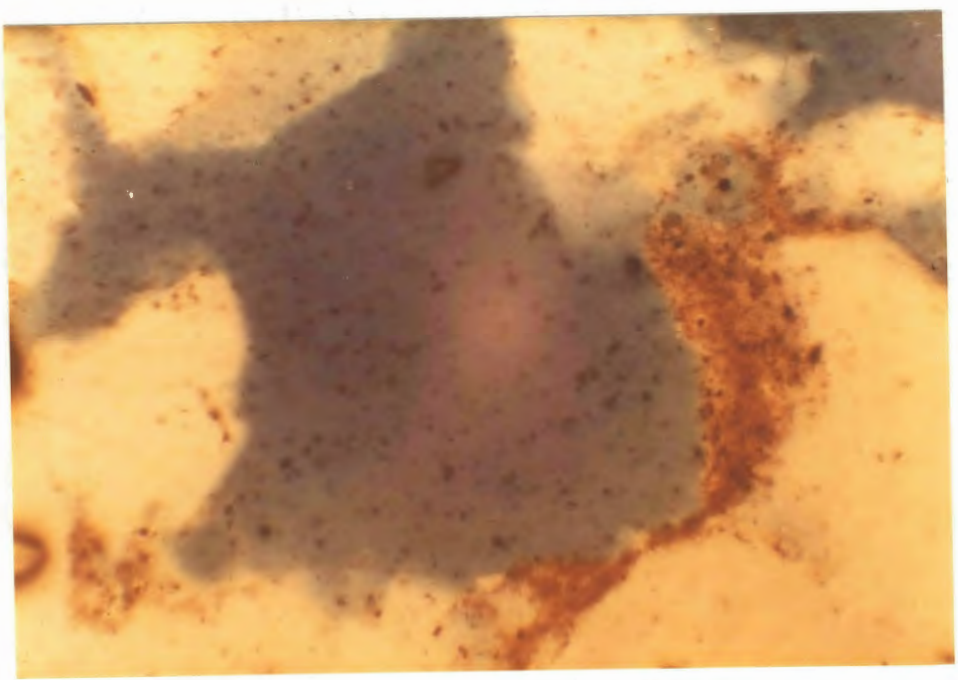


Fig. 6.-Dissolution of calcite cement. A) Calcite has been removed completely from the area in the upper-right part of photograph; from Cities Service Co., Cantrell No. 22, depth 2258 ft (SEM, X100). B) Oversized pore as a result of calcite dissolution; from Perkins Production Co., Records No. 1, depth 2169 ft (plane polarized, X100)

A)

B)

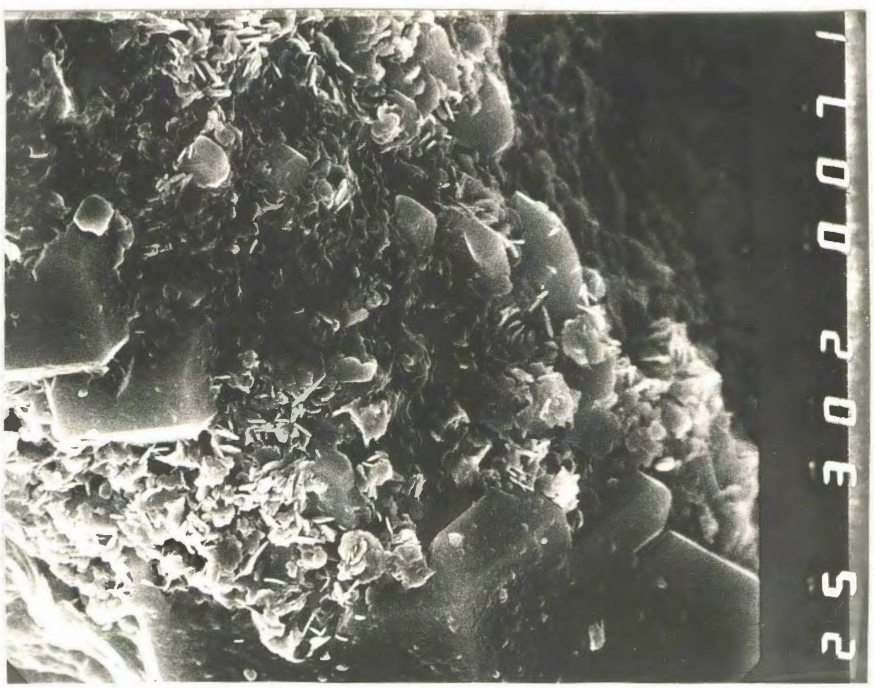


Fig. 7.-Late-phase clays coating detrital grains. A) Chlorite precipitated in a partially dissolved quartz grain (SEM, X3000). B) Mixed layer clay (probably illite) coating a quartz grain (SEM, X3000); both from Mack Oil Co., Beaver Creek Unit Tract No. 1-3, depth 2178 ft

A)

B)

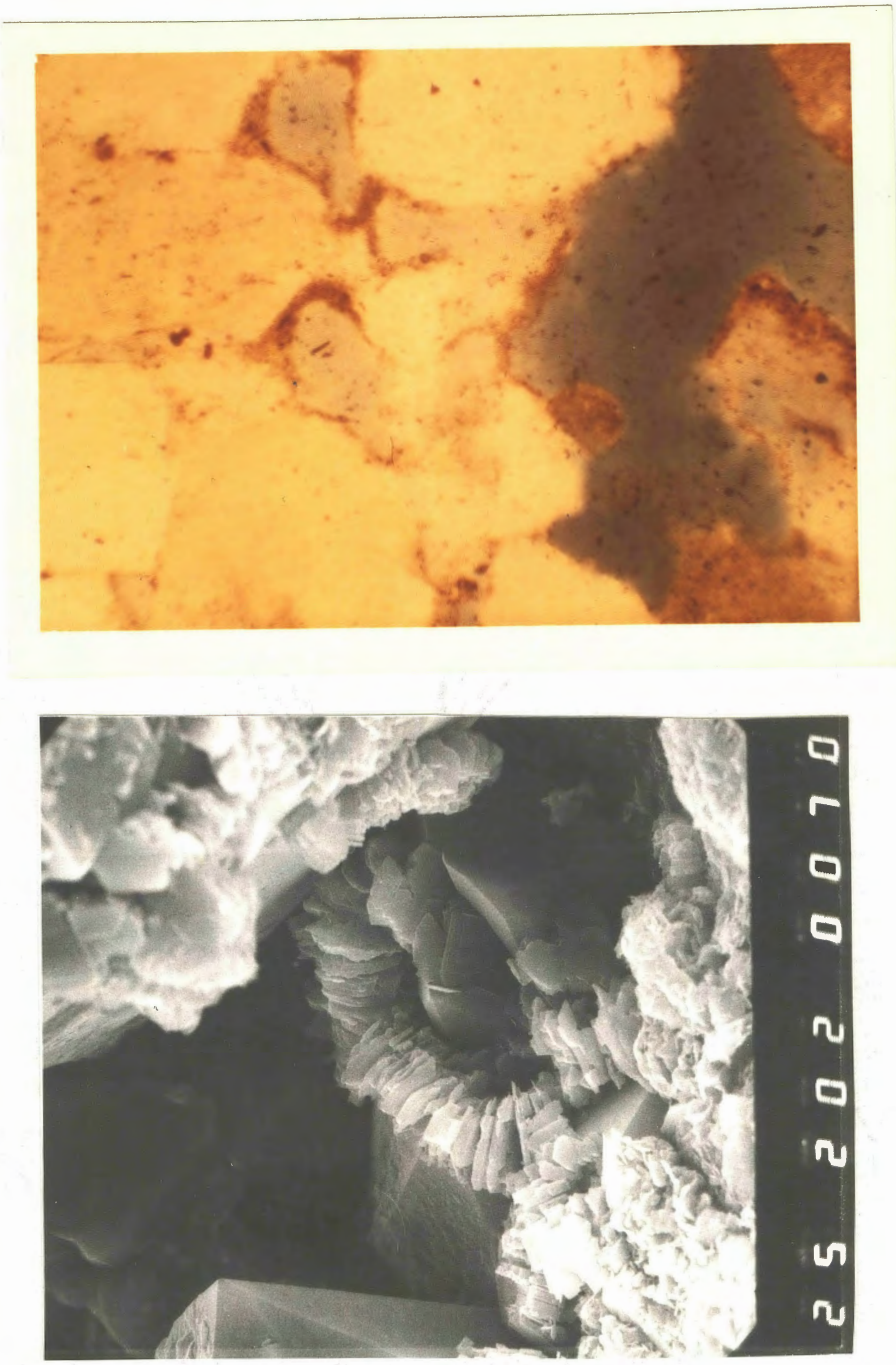


Fig. 8.-Late-phase clays coating and filling pores. A) Illite (brown) choking pore throats; from Perkins Production Co., Records No. 1, depth 2169 ft (plane polarized, X100). B) Kaolinite booklet precipitated in a pore; from Mack Oil Co., Beaver Creek Unit Tract, No. 1-3, depth 2178 ft (SEM, X2000)

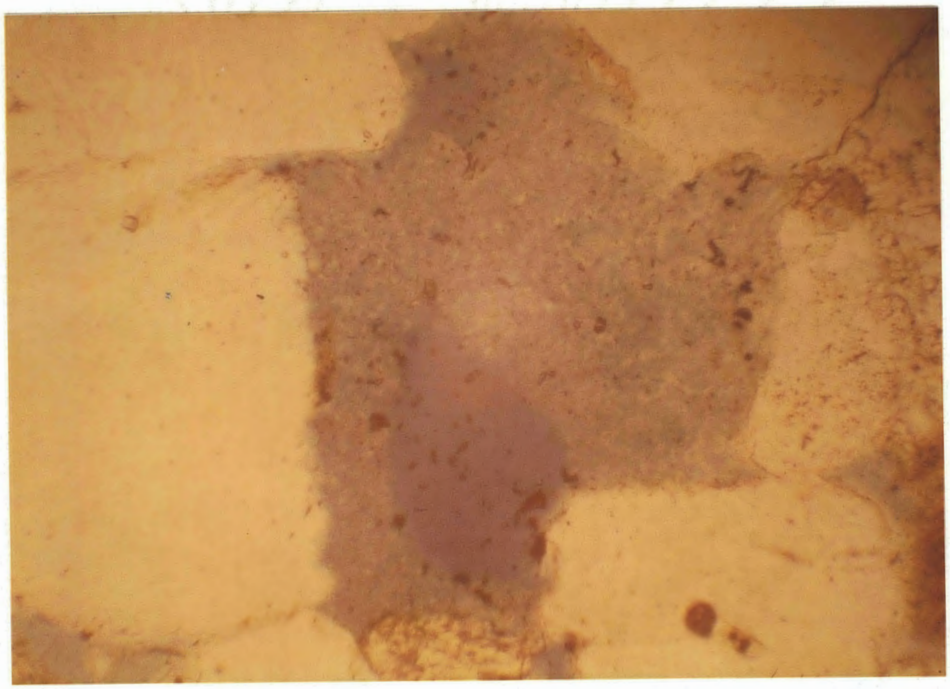


Fig. 9.-Microporosity developed in kaolinite. The microporosity is shown by a lighter shade of blue epoxy located in the center of photograph; from Perkins Production Co., Records No. 1, depth 2144 ft, (plane polarized, X100)

CHAPTER VII

URANIUM POTENTIAL

Introduction

Several surveys were completed to aid in evaluation of the uranium potential in the study area:

1. Soil and stream-sediment were sampled randomly throughout the study area. Rocks were sampled at most outcrops.

2. Scintillometer and gamma-ray spectrometer readings were made at each sample location.

3. Bit cuttings from three wells drilled in the Texas portion of the study area were analyzed with a scintillometer for anomalously high readings.

4. A gamma-ray well-log survey was conducted.

5. All available cores were checked with a scintillometer for unusually high radioactivity.

Occurrences of Uranium

Six uranium occurrences have been reported in the study area (Chase, 1954; Olmsted, 1975; and Al-Shaieb and others, 1980). Table I and Plate 16 outline and show the locations of these uranium prospects.

Most of the uranium occurrences in the study area might be positively associated with the structural geology of the area. Morrison (1977,

TABLE I

OUTLINE OF URANIUM OCCURRENCES

Occurrence No.	Name	County	Location	Deposit Class
12	Benson's farm prospect	Cotton	SW NE NE 3-5S-11W	Channel-controlled peneconcordant
14	Unnamed radio-activity anomaly	Clay, TX	Sec. 33, Byers Bros. subdivision	Channel-controlled peneconcordant
15	Uriah Miller Ranch prospect	Jefferson	NW SW 7-5S-8W	Sandstone
16	Unamed radio-activity anomaly	Jefferson	SW SW NW 17-5S-8W	Channel-controlled peneconcordant
17	Unnamed radio-activity anomaly	Jefferson	SW 30-5S-8W	Sandstone
18	Unnamed radio-activity anomaly	Clay, TX	Sec. 10, A-307, Montague Co. School Land	Channel-controlled peneconcordant

(From Al-Shaieb and others, 1980)

p. 38) believed that surface anomalies were related primarily to faulting. By comparing the locations of uranium mineralization (Plate 16) and the structural geologic map (Plate 7) it is apparent that Occurrences 14 and 18 could be correlated positively to the Red River Arch, suggesting some causal relation. Occurrence 17, and possibly 15 and 16, could be related to faulting along the Waurika-Muenster Arch.

Gamma-Ray Log Survey

The following guidelines (Hansen, 1977; and Lee, 1980) were used to determine anomalous zones on gamma-ray logs.

1. The anomalous zone must be below the shallowest occurrence (top) of arkose.

2. The anomalous zone must be in conglomerate, sandstone, or siltstone (as determined by self-potential deflection).

3. The gamma-ray intensity must be significantly higher than background. Twice the background value is taken here to be "significant."

Four subsurface anomalies were found using the above criteria (Appendix D and Plate 16). Depths of the anomalies range from 1630 to 4550 ft. It appears that a positive relationship exists between petroleum occurrences and anomalous gamma-ray values (cf. Fig. 10 and Plate 16). However, this apparent causal relationship may be due to exclusive use of gamma-ray logging in established oil fields.

These subsurface anomalies shown on gamma-ray logs do not coincide in location with surface anomalies (Plate 16). However, gamma-ray logs in the study area are rare; the total number of gamma-ray logs is only seven percent of the total number of borehole well logs used in this investigation.

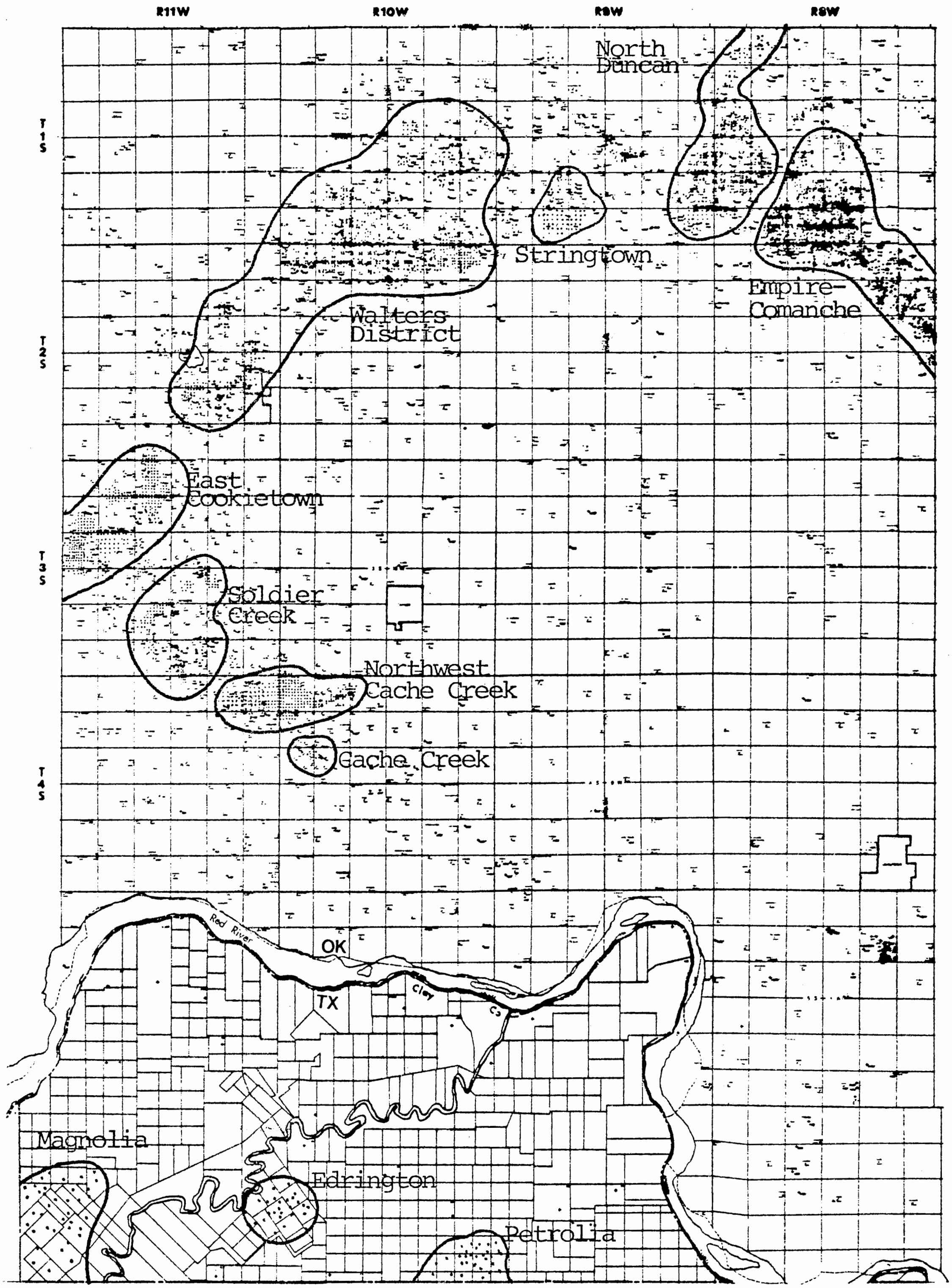


Fig. 10.-Locations of oil fields in the study area

Surface Sample Survey

Information gathered from the analyses of soil, stream sediment, and rock samples is shown in Appendix C; sample locations are shown on Plate 17. Scintillometer and spectrometer analyses of the uranium occurrences in the area are presented in Table II.

Bit-Cutting and Core Survey

None of the cores (Appendix A) or bit-cuttings (Appendix B) described in this study were found to be anomalously radioactive. A scintillometer was used in the survey.

Summary

Several factors indicate that the study area may be favorable geologically for discovery of uranium mineralization.

1. A limited survey of the surface indicated at least six radioactive anomalies in the area (Al-Shaieb and others, 1980).

2. A survey of the small number of gamma-ray logs resulted in detection of several subsurface radioactivity anomalies.

3. Study of bit cuttings and cores from wells indicates an abundance of arkosic sandstones and conglomerates, which are believed to be rock types favorable for uranium mineralization (Al-Shaieb and others, 1977a,b).

4. Carbonized wood, which can act as a reductant in uranium mineralization, was found in bit-cuttings and cores.

5. Microscopic study indicates the presence of secondary porosity in most of the sandstones. Porosity in sandstones is necessary so that pore fluids can migrate.

TABLE II

RADIOMETRIC AND RELATED GEOCHEMICAL RESULTS
FOR URANIUM OCCURRENCES

Occurrence Number	12	14	16	18
Sample Number	MGY 337,338	MGY 339	MGY 359,360	MGY 373,258
Total Gamma-ray Count*	1,400; 140	350	200; 180	460; 180
Gamma-ray Spectrometer data**				
Total	79,360 8,440	17,770	12,160 10,790	18,180 11,430
K	3,694 469	783	457 436	902 396
U	5,071 378	679	475 426	1,022 603
Th	201 73	225	157 153	91 191
Th/U ratio	0.04 0.19	0.33	0.33 0.36	0.09 0.32
U_3O_8 (DNAA) (ppm)	539.2 74.12	36.92	12.71 5.56	72.21 17.02
V (ppm)	35 65	42	70 45	3,030 85
V/U ratio	0.06 0.88	1.14	5.51 8.09	41.96 4.99
Significant Associated Elements (ppm)	none Cu(4,100)	Cu(4,100)	Cu(225) Cu(167)	Cu(518) Cu(342)

*counts per second

**counts per minute

(From Al-Shaieb and others, 1980)

6. The Wichita Granite is a potential source of uranium ions (Al-Shaieb and others, 1978). Groundwater could have become saturated in uranium ions by percolating through sediment derived from the Wichita Granite. This uranium may have precipitated in coarse clastic sediments.

7. Morrison (1977) and Al-Shaieb and others (1978) indicated that faults and oil-productive structural traps are positively correlated with uranium mineralization in some areas. Therefore, the presences of faulting and oil production in the study area can be regarded as favorable evidence.

CHAPTER VIII

SUMMARY

Principal conclusions of this study are as follows:

1. Structural elements in the area are a result of aulacogen formation and destruction.

2. Structural deformation, i.e. faulting, proceeded at least through middle Virgilian.

3. Virgilian through Wolfcampian strata show an overall pattern of basin filling and marine regression.

4. Abundance of limestone probably marks the location of the basin's ancient shelf.

5. Depositional environments ranged from basin to alluvial plain and piedmont.

6. The primary source of clastic material probably was the Wichita Granite; the Red River Arch was an intermittent source.

7. Diagenesis of Cisco Group sandstones occurred in several phases which included the cementation of the sandstones, destruction of primary porosity, subsequent dissolution of cement, and formation of secondary porosity.

8. Surface and subsurface radioactivity anomalies, abundance of arkosic rocks, presence of carbonized wood in cores and bit-cuttings, faults and oil-production in the area, porosity in sandstones, and proximity of an uranium-ion source, the Wichita Granite, are evidence that

conditions may have been favorable for uranium mineralization in the Marietta Basin and on the Waurika-Muenster Arch.

SELECTED REFERENCES

Al-Shaieb, Z. F., J. W. Shelton, and others, 1977a, Uranium potential of Permian and Pennsylvanian sandstones in Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 61, p. 360-375.

Al-Shaieb, Z. F., J. W. Shelton, and others, 1977b, Evaluation of uranium potential in selected Pennsylvanian and Permian units and igneous rocks in southwestern Oklahoma: Report for Bendix Field Engineering Corp. subcontract 76-024-E, 241 p.

Al-Shaieb, Z. F., 1978, Guidebook to uranium mineralization in sedimentary and igneous rocks of Wichita Mountains region, southwestern Oklahoma: Oklahoma City Geological Soc., Fieldtrip Guidebook, 73 p.

Al-Shaieb, Z. F., R. G. Thomas, and G. F. Stewart, 1980, National uranium resource evaluation, Lawton quadrangle, Oklahoma and Texas: U. S. Department of Energy, Open file report, (in press).

Blackburn, G., and R. M. Taylor, 1969, Limestones and red soils of Bermuda: Geol. Soc. America Bull., v. 80, p. 1595-1598; see also Bricker, O. P., and F. T. MacKenzie, 1970, Limestones and red soils of Bermuda: discussion: Geol. Soc. America Bull., v. 81, p. 2523-2524; and Blackburn, G., and R. M. Taylor, 1970, Limestones and red soils of Bermuda: reply: Geol. Soc. America Bull., v. 81, p. 193-194.

Blatt, H., 1979, Diagenetic processes in sandstones, in Scholle, P. A. and P. R. Schluger (eds.), Aspects of diagenesis: Soc. Economic Paleontologists and Mineralogists Spec. Pub. 26, p. 141-157.

Bradfield, H. H., 1968, Stratigraphy of deeper Marietta Basin in Oklahoma and Texas (abs.): Am. Assoc. Petroleum Geologist Bull., v. 52, p. 193-194.

Brown, L. F., Jr., 1959, Problems of stratigraphic nomenclature and classification, Upper Pennsylvanian, north-central Texas: Am. Assoc. Petroleum Geologists Bull., v. 43, p. 2866-2871.

________, 1962, A stratigraphic datum, Cisco Group (Upper Pennsylvanian), Brazos and Trinity Valleys, north-central Texas: Univ. Texas Bur. Econ. Geol. Rept. Inv. 46, 42 p.

________, 1969a, Late Pennsylvanian paralic sediments, in Brown, L. F., Jr., and E. G. Wermund (eds.), Guidebook to the Late Pennsylvanian sediments, north-central Texas: Dallas Geol. Society, for Annual meeting of the Am. Assoc. Petroleum Geologists, p. 21-33.

________, 1969b, Geometry and distribution of fluvial and deltaic sandstones (Pennsylvanian and Permian), north-central Texas: Gulf Coast Assoc. Geol. Socs. Trans., v. 19, p. 23-47.

________, 1972, Virgil and Lower Wolfcamp repetitive environments and the depositional model, north-central Texas, in Elam, J. G., and S. Chuber (eds.), Cyclic sedimentation in the Permian Basin, second edition: West Texas Geol. Soc., p. 115-134.

________, A. W. Cleaves, III, and A. W. Erxleben, 1973, Pennsylvanian depositional systems in north-central Texas: Texas Univ. Bur. Econ. Geology Guidebook no. 14, 122 p.

Burke, K., and J. F. Dewey, 1973, Plume-generated triple junctions: key indicators in applying plate tectonics to old rocks: Jour. Geology, v. 81, p. 406-433.

Bunn, J. R., 1930, Jefferson County, in Oil and gas in Oklahoma: Oklahoma Geol. Survey Bull. 40, v. 2, pp. 341-382.

Chase, G. W., 1954, Occurence of radioactive material in sandstone lenses of southwestern Oklahoma: Oklahoma Geol. Survey Mineral Rept. 26, 7 p.

Cheney, M. G., 1940, Geology of north-central Texas: Am. Assoc. Petroleum Geologists Bull., v. 24, p. 65-118.

Cipriani, D., 1956, Southwest Randlett field, in Petroleum geology of southern Oklahoma, a symposium; sponsored by the Ardmore Geological Society, v. 1: Am. Assoc. Petroleum Geologists, p. 311-318.

Cloud, W. F., 1930, Cotton County, in Oil and gas in Oklahoma: Oklahoma Geol. Survey Bull. 40, v. 2, p. 323-340.

Denison, R. E., 1978, The Ouachita Foldbelt: A Paleozoic continental margin, in Structural Style of the Arbuckle region: Geol. Soc. Amer. south-central region guidebook field trip 3, p. 48-64.

Druitt, C. E., 1957, "The subsurface geology of Jefferson Co." M. S. thesis, Oklahoma University, 39 p.

Dutton, S. P., 1979, Pennsylvanian fan delta sandstones of the Palo Duro Basin, Texas, in Hyne, N. D. (ed.), Pennsylvanian sandstones of the mid-continent: Tulsa Geol. Society Spec. Pub. no. 1, p. 235-245.

Erxleben, A. W., 1974, "Depositional systems in the Canyon Group (Pennsylvanian), north-central Texas." M. S. thesis, University of Texas at Austin, 201 p.

Feray, D. E., 1972, Tectonic versus eustatic control of Pennsylvanian cyclical sedimentation in north-central Texas (abs.), in Elam, J. G. and S. Chuber (eds.), Cyclic sedimentation in the Permian Basin, second edition: West Texas Geol. Soc., p. 81.

Flawn, P. T., 1956, Basement rocks of Texas and southeast New Mexico: Univ. Texas Bur. Econ. Geol. Pub. 5605, p. 36-39.

Frezon, S. E. and G. H. Dixon, 1967, Texas panhandle and Oklahoma, in Paleotectonic investigations of the Pennsylvanian system in the United States: U. S. Geol. Survey Prof. Paper 853, v. 1, p. 177-195.

Friedman, G. M., and J. E. Sanders, 1978, Principles of Sedimentology. New York: John Wiley and Sons, 792 p.

Forgotson, J. M., Jr., 1957, Nature, usage and definition of marker-defined vertically segregated rock units: Am. Assoc. Petroleum Geologists Bull., v. 41, p. 2108-2113.

Galloway, W. E. and L. F. Brown, Jr., 1972, Depositional systems and shelf slope relationships in Upper Pennsylvanian rocks, north-central Texas: Univ. Texas Bur. Econ. Geology Rept. Inv. 75, 63 p.

________ and ________, 1973, Depositional systems and shelf-slope relation on cratonic basin margin uppermost Pennsylvanian of north-central Texas: Am. Assoc. Petroleum Geologists Bull., v. 57, p. 1185-1218.

Gilreath, J. A., and R. W. Stephens, 1975, Interpretation of log responses in a deltaic environment, in Finding and exploring ancient deltas in the subsurface: Am. Assoc. Petroleum Geologists Marine Geology Committee Workshop, p. C1-C31.

Gouin, F., 1930a, Comanche County, in Oil and gas in Oklahoma: Oklahoma Geol. Survey Bull. 40, v. 2, p. 203-223.

________, 1930b, Stephens County, in Oil and gas in Oklahoma Geol. Survey Bull. 40, v. 2, p. 21-66.

Ham, W. E., R. E. Denison, and C. A. Morris, 1964, Basement rocks and structural evolution, southern Oklahoma: Oklahoma Geol. Survey Bull. 95, 301 p.

Ham, W. E. and J. E. Wilson, 1967, Paleozoic epeirogeny and orogeny in the central United States: Am. Jour, Sci., v. 265, p. 332-407.

Handford, R. C., and S. P. Dutton, 1980, Pennsylvanian-Early Permian depositional systems and shelf-margin evolution, Palo Duro Basin, Texas: Am. Assoc. Petroleum Geologists Bull., v. 64, p. 88-106.

Hansen, C. E., 1977, "Subsurface Virgilian and Lower Permian arkosic facies, Wichita Uplift-Anadarko Basin, Oklahoma." M. S. thesis, Oklahoma State University, 63 p.

Havens, J. S., 1977, Reconnaissance of the water resources of the Lawton quadrangle, southwestern Oklahoma: Oklahoma Geol. Survey Hydrologic Atlas, Scale 1:250,000.

Hayes, J. B., 1979, Sandstone diagenesis, the hole truth, in Scholle, P. A. and P. R. Schluger (eds.), Aspects of diagenesis: Soc. Economic Paleontologists and Mineralogists Spec. Pub. 26, p. 127-139.

Henry, G. E., 1968, Recent developments in the Marietta basin (abs.): Shale Shaker, v. 18, no. 5, p. 100.

Hoffman, P., J. F. Dewey, and K. Burke, 1974, Aulacogens and their genetic relation to geosynclines, with a Proterozoic example from Great Slave Lake, Canada, in Dott, R. H., Jr., and R. H. Shaver (eds.), Modern and ancient geosynclinal sedimentation: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 19, p. 38-55.

James, N. P., 1972, Holocene and Pleistocene calcareous crust (caliche) profiles: criteria for subaerial exposure: Jour. Sed. Petrology, v. 42, p. 817-836.

Jordon, L., 1957, Subsurface stratigraphic names of Oklahoma: Oklahoma Geol. Survey Guidebook, v. 1, 220 p.

Kendrick, F. E. and H. C. McLaughlin, 1929, Relation of petroleum accumulation to structure, Petrolia field, Clay County, Texas, in Structure of typical American oil fields, v. 2: Am. Assoc. Petroleum Geologists, p. 542-555.

King. P. B., 1975, Ancient southern margin of North America: Geology, v. 3, p. 732-734.

LeBlanc, R. J., Sr., 1977, Distribution and continuity of sandstone reservoirs-parts 1-2: Jour. Petroleum Tech., v. 29, p. 776-850.

Lee, B. E., 1980, "Stratigraphy, sedimentology, and uranium potential of Virgilian-Leonardian strata of the Hollis-Hardman Basin, Oklahoma and Texas." M. S. thesis, Oklahoma State University, 97 p.

MacLachlan, M. E., 1967, Oklahoma, in Paleotectonic investigations of the Permian System in the United States: U. S. Geol. Survey Prof. Paper 515, p. 85-92.

McBee, W., Jr., and L. G. Vaughan, 1956, Oil fields of the central Muenster-Waurika Arch, Jefferson County, Oklahoma, and Montague County, Texas, in Petroleum geology of southern Oklahoma, a symposium; sponsored by the Ardmore Geological Society, v. 1: Am. Assoc. Petroleum Geologists, p. 355-372.

Moore, R. C., C. G. Lalicker, and A. G. Fischer, 1952, Invertebrate fossils. New York: McGraw-Hill, Inc., 766 p.

Morrison, C. M., 1977, "Permian uranium-bearing sandstones on the Muenster-Waurika Arch and in the Red River area." M. S. thesis, Oklahoma State University, 60 p.

Olmsted, R. W., 1975, "Geochemical studies of uranium in south-central Oklahoma." M. S. thesis, Oklahoma State University, 116 p.

Pate, J. D., 1948, Cotton County, poor boy's paradise: World Oil, v. 128, no. 6, p. 122-124.

Pettijohn, F. J., P. E. Potter, and R. Siever, 1972, Sand and sandstone. New York: Springer-Verlag, 618 p.

Plummer, F. B., and R. C. Moore, 1921, Stratigraphy of the Pennsylvanian formations of north-central Texas: Univ. Texas Bull. 2132, 237 p.

Powell, B. N., and D. W. Phelps, 1977, Igneous cumulates of the Wichita province and their tectonic implications: Jour. Geology, v. 5, p. 52-56.

Putman, D. M. 1959, The west Duncan field, in Petroleum geology of southern Oklahoma, a symposium; sponsored by the Ardmore Geological Society, v. 2: Am. Assoc. Petroleum Geologists, p. 319-326.

Reading, H. G., (ed.), 1978, Sedimentary environments and faces. New York: Elsevier North-Holland, 557 p.

Robberson, T. A., in progress, "Stratigraphy and uranium potential of Virgilian through Leonardian strata in parts of Comanche, Cotton and Tillman Counties, Oklahoma, and Wichita County, Texas." M. S. thesis, Oklahoma State University.

Schmidt, V. and D. A. McDonald, 1979, Texture and recognition of secondary porosity in sandstones, in Scholle, P. A. and P. R. Schluger (eds.), Aspects of diagenesis: Soc. Economic Paleontologists and Mineralogists Spec. Pub. 26, p. 209-225.

Schopf, J. M., 1975, Pennsylvanian climate in the United States, in Paleotectonic investigations of the Pennsylvanian System in the United States: U. S. Geol. Survey Prof. Paper 853, v. 2, p. 23-31.

Shelton, J. W., 1973, Models of sand and sandstone deposits: a methodology for determining sand genesis and trend: Oklahoma Geol. Survey Bull. 118, 122 p.

Sneider, R. M., and others, 1977, Predicting reservoir rock geometry and continuity in Pennsylvanian reservoirs, Elk City field, Oklahoma: Jour. Petroleum Tech., v. 29, p. 851-866.

Soleis, R., 1980, Personal communication on stratigraphy of northern Texas.

Stanton, C. D., and others, 1977, Uranium favorability of southwestern Oklahoma and north-central Texas: U. S. Energy and Development Administration contract no. E(05-1)-1664, 36 p.

Swigart, T. E., 1919, Underground problems in the Comanche oil and gas field, Stephens County, Oklahoma: U. S. Bur. Mines in cooperation with the state of Oklahoma, 42 p.

________, 1920, Report on the underground conditions in the Walters oil and gas field: U. S. Bur. Mines in cooperation with the state of Oklahoma, 24 p.

Tomlinson, C. W. and McBee, W., Jr., 1959, Pennsylvanian sediments and orogenies of Ardmore district, Oklahoma, in Petroleum geology of southern Oklahoma, a symposium; sponsored by the Ardmore Geological Society, v. 2: Am. Assoc. Petroleum Geologists, p. 3-52.

Troutman, A., (ed.), 1957, Ira Rinehart's Archer, Baylor, and Clay Counties reference book. Dallas: Rinehart Oil News, Co., 284 p.

U. S. Atomic Energy Commission, 1968, Preliminary reconnaissance for uranium in Kansas, Nebraska, and Oklahoma, 1951-56: U. S. Atomic Energy Commission Rept. RME 151,73 p.

Waller, T. H. 1969, Lower Cisco carbonate deposition in north-central Texas, in Brown, L. F., Jr. and E. G. Wermund (eds.), Guidebook to the Late Pennsylvanian sediments, north-central Texas: Dallas Geol. Society, for Annual meeting of the Am. Assoc. Petroleum Geologists, p. 34-39.

Walper, J. L., 1976, Geotectonic evolution of the Wichita aulacogen, Oklahoma (abs.): Am. Assoc. Petroleum Geologists Bull., v. 60, p. 327-328.

________, 1977, Paleozoic tectonics of the southern margin of North America: Gulf Coast Assoc. Geol. Soc. Trans., v. 27, p. 230-241.

Webster, R. E., 1980, Evolution of south Oklahoma aulacogen: Oil and Gas Journal, v. 78, no. 9, p. 150-172.

Wermund, E. G., and W. A. Jenkins, Jr., 1969, Late Pennsylvanian series in north-central Texas, in Brown, L. F., Jr. and E. G. Wermund (eds.), Guidebook to the Late Pennsylvanian sediments, north-central Texas: Dallas Geol. Society, for Annual meeting of the Am. Assoc. Petroleum Geologists, p. 1-11.

________ and ________, 1970, Recognition of deltas by fitting trend surfaces to Upper Pennsylvanian sandstones in north-central Texas, in Morgan, J. P. (ed.), Deltaic sedimentation, modern and ancient: Soc. Econ. Paleontologists and Mineralogists Spec. Publ, no. 15, p. 256-269.

Wermund, E. G., 1975, Upper Pennsylvanian limestone banks, north-central Texas: Texas Univ. Bur. Econ. Geology Circ. 75-3. 34 p.

Wickham, J., 1978, The southern Oklahoma aulacogen, in structural style of the Arbuckle region: Geol. Soc. Amer. south-central region guidebook field trip 3, p. 8-41.

APPENDIX A

DESCRIPTIONS OF CORES

Introduction

Six cores were examined in the course of this study; their borehole locations are shown in Plate 18. Two of the cores are from the Missourian Hoxbar Group. Although the Hoxbar Group was not included in other aspects of this study it was dealt with here because recognition of Missourian depositional environments could aid in estimating overall basinal history. The remaining four cores are from various units of Virgilian age.

The low density of electric logs, lack of micrologs and wide spacing of the cores, both stratigraphically and laterally, have made impractical any attempt to calibrate electric-logs or to delimit particular rock units shown in the cores. Therefore it is impossible to determine geometry, trend, and boundary relationships, which are important criteria for interpretation of depositional environments. Nevertheless, approximations of depositional environments were made using stable information, such as proximity to source area, evidence of paleoclimate, general tectonic setting, and the internal features described from the cores.

Selected cores were divided into several units which are discussed separately. Each unit is believed to represent a specific depositional environment.

Core from Perkins Production Co., Carr No. 1

Location, Position, and Boundaries

Geographic Location. The core (Fig. 11) is from the Perkins Production Co., Carr No. 1, located in the NW¼, Sec. 6, T2S, R10W, in the Walters District, Cotton County, Oklahoma (Plate 18).

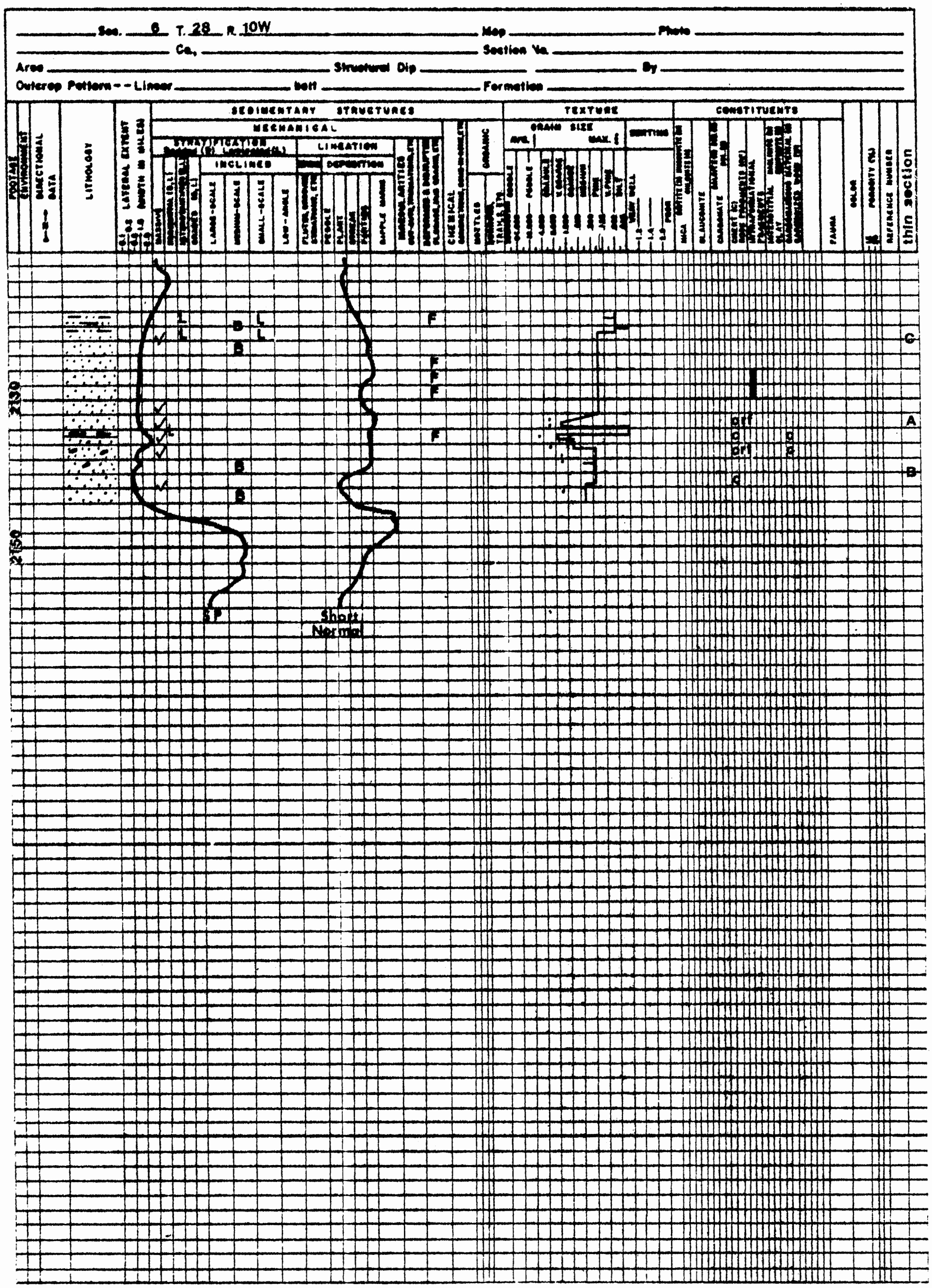


Fig. 11.-Description of core from the Perkins Production Co., Carr No. 1

Vertical Position. Stratigraphically, the core is in the lower half of Interval 1, above the upper marker of Subinterval 1A (Plate 8). The core consists of rock from 2118-2144 ft and will be discussed as a single unit.

Boundaries. Upper and lower contacts are sharp.

Internal Features

Sedimentary Structures. Flowage, medium-scale cross-bedding, small-scale cross-lamination, and massive bedding characterize the sandstones. The upper section of the core is interlaminated. Horizontal lamination is common in the mudstones.

Textures and Constituents. A wide range exists in both grain size and maturity of the sandstones in this interval. Some units are conglomeratic and texturally immature. Carbonaceous material is present in minor amounts. Generally, the grain size decreases upwards. The sandstones range from lithic subarkoses to quartzarenites. Calcite and kaolinite cements are present.

Depositional Environment

The strata cored by this well probably were deposited in an alluvial plain environment. Lack of marine indicators, grain size, and medium scale cross-beds suggest deposition of the sandstones as bars in an alluvial plain. The mudstones could have been deposited in an abandoned channel.

Core from Cities Service Co., Cantrell No. 22

Location, Position, and Boundaries

Geographic Location. The core (Fig. 12) is from the Cities Service Co., Cantrell No. 22 well, in the SE¼, Sec. 32, T1S, R8W, in the Empire-Comanche Field, Stephens County, Oklahoma (Plate 18).

Vertical Position. Two intervals were covered, from 2248-2264 ft and from 2189-2180 ft. The core is located in the lower part of Interval 1 (Plate 8), but above the Fusulinid Limestone Member. Both intervals will be discussed as a single unit.

Boundaries. Lower contacts of sandstones are erosive; the upper contacts were not cored.

Internal Features

Sedimentary Structures. Medium-scale cross-bedding possible initial dip, and abundant flowage are in the sandstones (Fig. 13). Small-scale cross-lamination and interlamination also are present.

Texture and Constituents. The cored sandstone is fine to coarse-grained and moderately to well sorted. Muscovite, microcline, plagioclase (oligoclase), garnet and zircon are minor constituents. Some 15 mm diameter clasts of mudstone are present, especially in the lower parts of sandstone units. Calcite cement is abundant in some parts of the rock, causing a high deflection in the resistivity curves.

Depositional Environment

Texture, medium-scale cross-bedding, initial dip, sharp basal

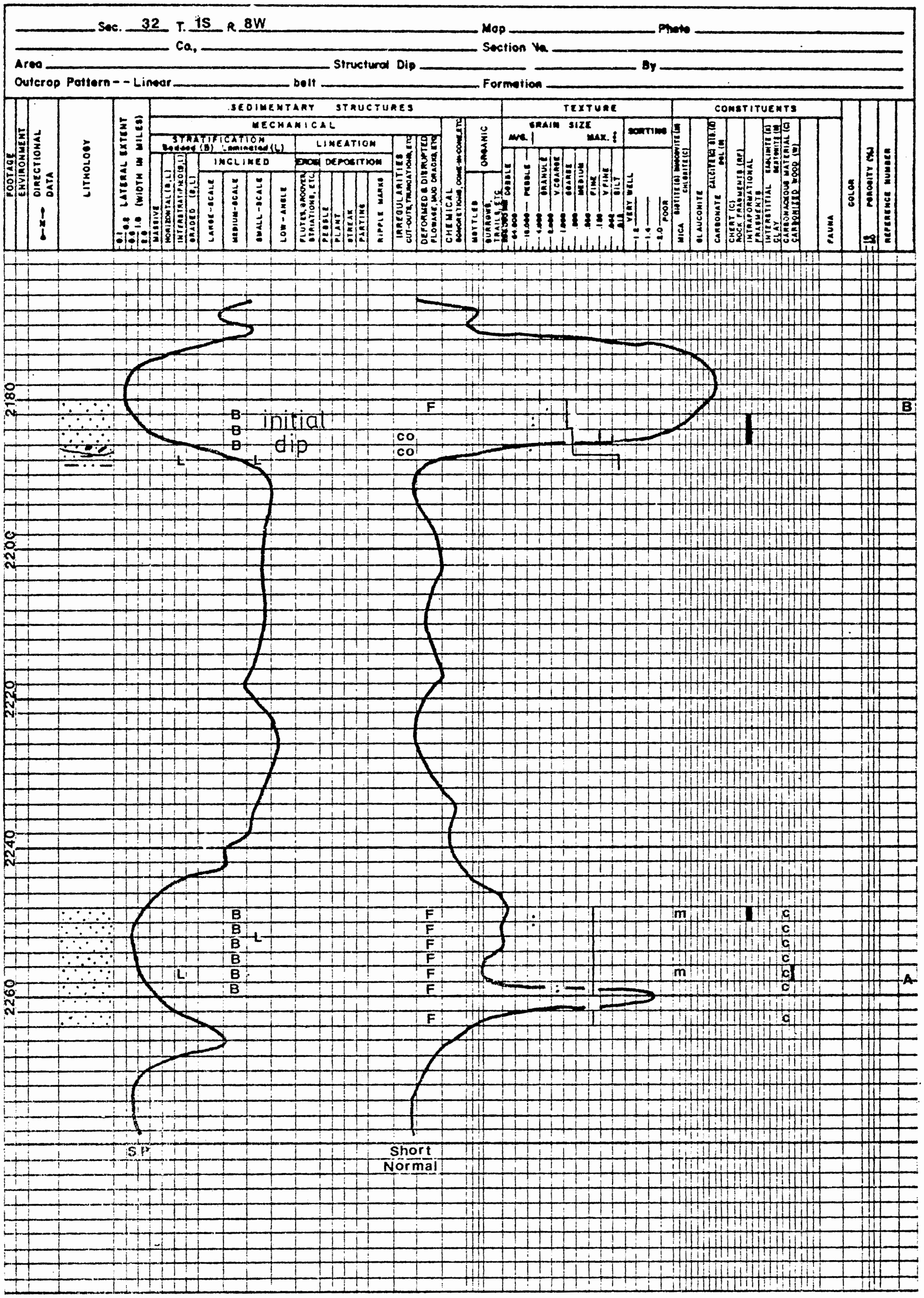


Fig. 12.-Description of core from the Cities Service Co., Cantrell No. 22

Fig. 13.-Flowage (1), medium-scale cross-bedding
(2), and soft-sediment faulting
(3) in sandstone; from Cities Service
Co., Cantrell No. 22, depth 2254 ft

contacts, and intraformational fragments are evidence that converges on the conclusion of deposition on an alluvial plain. The interlaminated unit probably was deposited as overbank material.

Core from Mack Oil Co., Beaver Creek

Unit Tract No. 1-3

Location, Position, and Boundaries

Geographic Location. The core (Fig. 14) is from the Mack Oil Co., Beaver Creek Unit Tract No. 1-3, located in the SE¼, Sec. 16, T1S, R9W, Cotton County, Oklahoma (Plate 18).

Vertical Position. The core is from beds in the lower section of Interval 1 (Plate 8), at 2164-2186 ft and 2195-2202 ft. Both intervals will be discussed as a single unit.

Boundaries. The lower boundaries are sharp and in places erosive; the upper contacts of sandstone units are sharp or gradational.

Internal Features

Sedimentary Structures. Small-scale cross-bedding, minor flowage, and interlamination are common in the sandstones and siltstones (Fig. 15). Interbedding of shales and sandstones is also prevalent. Mudstones are either massively or horizontally bedded. Chemical concretions ($CaCO_3$) are present in the upper shale unit.

Textures and Constituents. The sandstones range in texture and composition. Basal units are immature, coarse-grained, and have more unstable constituents such as carbonized wood; upper units are well sorted,

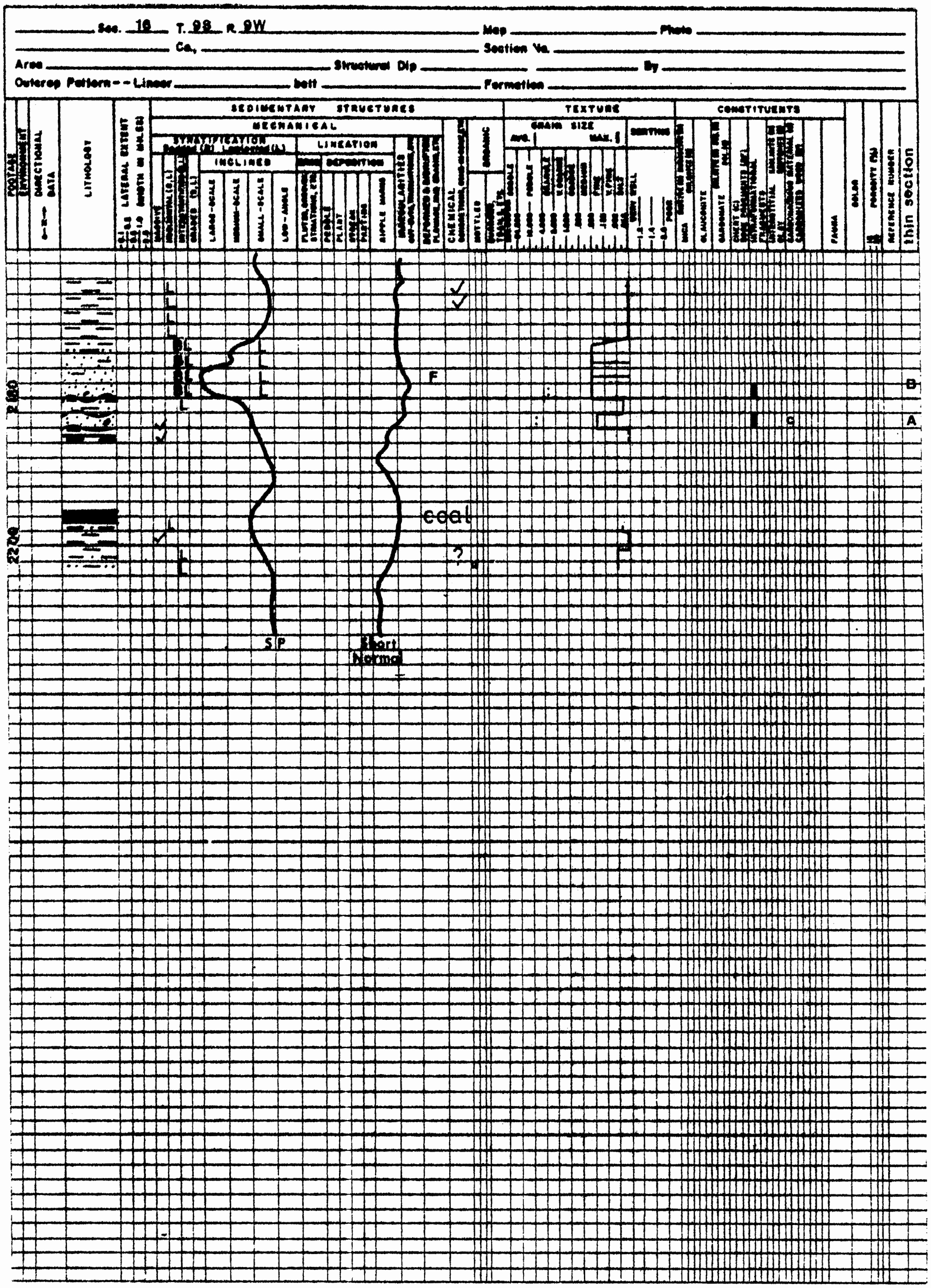


Fig. 14.-Description of core from the Mack Oil Co., Beaver Creek Unit Tract No. 1-3

Fig. 15.-Interlamination, small-scale cross-bedding, and minor flowage; from Mack Oil Co., Beaver Creek Unit Tract No. 3, depth 2177 ft

medium-grained, and mineralogically mature. In a general way the grain size decreases upward. Besides copious quartz, the rock contains minor amounts of plagioclase (oligoclase), garnet and leucoxene. Mudstone pebbles as broad as 5 mm also are in the sandstones. The sandstones are subarkoses. A thin coal bed and carbonized wood are present. Calcite is rare as cement, and authigenic clays are common.

Depositional Environment

The strata cored by this well probably were deposited in an alluvial plain environment Carbonaceous material, interstratification, and texture indicate this environment of deposition. The upper mudstone unit could be an ancient soil and caliche horizon. The coal unit suggests swampy conditions. The interstratified sandstones and shales could have been deposited as splays or overbank material.

Core from Perkins Production Co., Records No. 1

Location, Position, and Boundaries

Geographic Location. The core (Fig. 16) taken from the Perkins Production Co., Records No. 1 well is in the SW¼ of Sec. 6, T2S, R10W, in the Walters District, Cotton County, Oklahoma (Plate 18).

Vertical Position. The interval cored is 2130-2170 ft deep and in the lower half of Interval 1 (Plate 8). The core is of the Priddy Sandstone Member. The entire core was treated as a single unit.

Boundaries. Upper contacts of the sandstones are gradational; basal contacts are sharp and erosive.

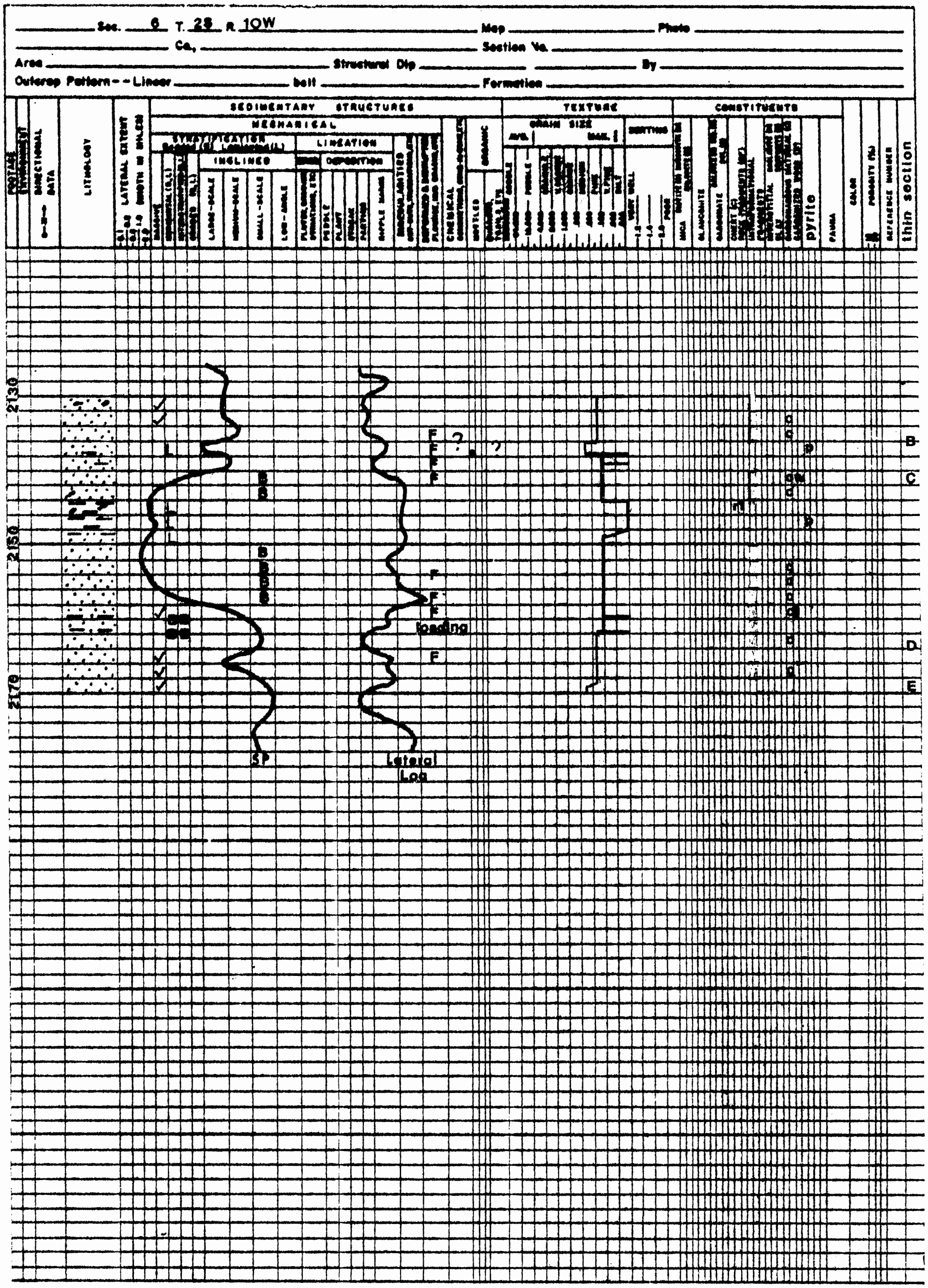


Fig. 16.-Description of core from the Perkins Production Co., Records No. 1

Internal Features

Sedimentary Structures. Abundant flowage, massive bedding, interstratification, horizontal lamination and bedding, and small-scale cross-bedding are in the sandstones of this interval. Mudstones commonly are horizontally laminated.

Texture and Constituents. Sandstones of this interval are fine-grained and mostly well sorted. Unstable grains, such as plagioclase, are rare. Rock fragments, as large as 20 mm are channel lag deposits. Carbonized wood fragments are in the sandstone beds. Sandstones range from lithic subarkoses to quartzarenites. Calcite, with minor amounts of clay, cements the sandstones.

Depositional Environment

The strata cored in this well probably were deposited in an alluvial plain environment. Cross-bedding, rock fragments, and grain sizes led to this conclusion. No marine indicators are present, efficaciously excluding a deltaic depositional setting. Mudstone deposition could have taken place within the cored interval.

Core from the Hall-Jones Limited, Sikes No. 3

Location, Position, and Boundaries

Geographic Location. The core (Fig. 17) taken from Hall-Jones Limited, Sikes No. 3 is in the SW¼ of Sec. 12, T1S, R8W, Stephens County, Oklahoma (Plate 18).

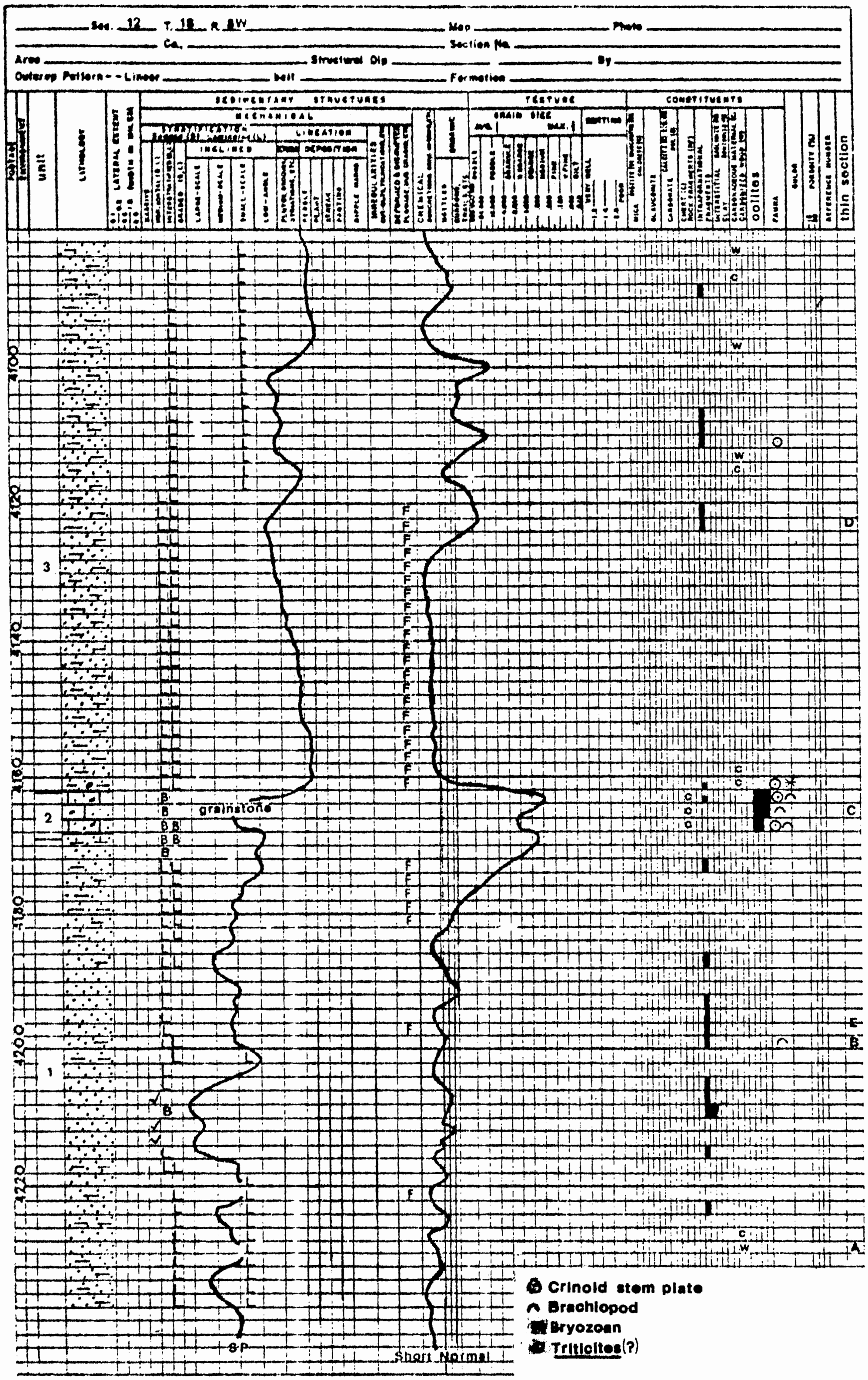


Fig. 17.-Description of core from the Hall-Jones Limited, Sikes No. 3

Vertical Position. The core is from the Missourian Hoxbar Group, or below Interval 2 (Plate 8). The core consists of rock from 4082-4238 ft.

Boundaries. Upper and lower boundaries of each unit are gradational.

Internal Features, Unit 1 (Fig. 17)

Sedimentary Structures. Horizontal interlamination and small-scale cross-interlamination (lenticular bedding) are prevalent in this lower unit. Massive bedding and minor flowage are also present.

Textures and Constituents. Rocks in this unit are interstratified mudstones and sandstones. Sandstone is fine - to medium - grained subarkoses and arkoses. Overall, grain size increases upward. Mudstone clasts and coarser sand are in the lower sections of sandstone intervals. Carbonized wood, brachiopods and other marine fossils are in this unit. Tourmaline and plagioclase (oligoclase) are contained in trace amounts. The cement is calcite.

Depositional Environment, Unit # 1

The depositional environment of Unit 1 may have been related to deltaic processes, specifically a delta-fringe environment. Upward increase in grain size, interstratification, marine fauna, carbonized wood, and general texture indicate this depositional setting. Medium-grained arkoses near the top of the interval could have been deposited in a bar associated with a channel.

Internal Features, Unit 2 (Fig. 17)

Sedimentary Structures. This relatively thin unit shows horizontal bedding.

Textures and Constituents. Unit 2 is a grainstone (oosparite). Grain size ranges from 0.5 mm to 13 mm. Cobble-sized chert grains are fairly well rounded. Medium-grained, well rounded, quartz sand is sparsely distribted in this limestone.

Biota. Fusulinids, brachiopods, bivalves and bryozoans are the identified fauna in this unit.

Depositional Environment, Unit 2

Oolites, well rounded grains and marine fauna indicate that the deposition of Unit 2 was in a turbid, near-shore environment. Unit 2 could be the record of marine transgression over an abandoned delta complex (Unit 1). Brown (1972) recognized evidence of this kind of a depositional event in some Virgilian rocks of north-central Texas.

Internal Features, Unit 3 (Fig. 17)

Sedimentary Structures. Interlamination, small-scale cross-bedding (lenticular bedding), and flowage are evident sedimentary structures (Fig. 18).

Texture and Constituents. Carbonized wood, crinoid stem plates, and mudstone clasts are in the upper half of the unit. The grain size, very fine sand, is fairly consistent upward; but the spontaneous potential curve shows increased negative deflection up the hole toward the 4120 depths (Fig.

Fig. 18.-Flowage and possibly burrowing in interlaminated sandstone and shale; from Hall-Jones Limited, Sikes No. 3, depth 4133 ft

17). Calcite cement is present where the sandstone is not oil stained.

Depositional Environment, Unit 3

Deposition in Unit 3, as in Unit 1, could represent deltaic advancement. A delta-fringe environment seems the most probable explanation because of the grain size of the sandstones.

Core from Pan American Petroleum, Inc.,

Philpott No. 1

Location, Position, and Boundaries

Geographic Locations. The core (Fig. 19) is from the Pan American Petroleum, Inc., Philpott No. 1 well, in the NW¼, Sec. 27, T2S, R10W, Cotton County, Oklahoma (Plate 18).

Vertical Position. The core is from the Missourian Hoxbar Group; it was below the lower marker of Interval 2 (Plate 4). The cored interval extends from 4030 to 4089 ft.

Boundaries. The basal contact of Unit 2 with Unit 1 is sharp but probably not erosive (Fig. 20). Contacts of the sandstone and overlying limestone are gradational. Contact of the uppermost mudstone and underlying limestone is thought to be gradational.

Internal Features, Unit 1 (Fig. 19)

Sedimentary Structures. Unit 1 is bedded horizontally and is interlaminated. The upper two-thirds of the unit is motted.

Texture and Constituents. The lower third of the unit is green silt-

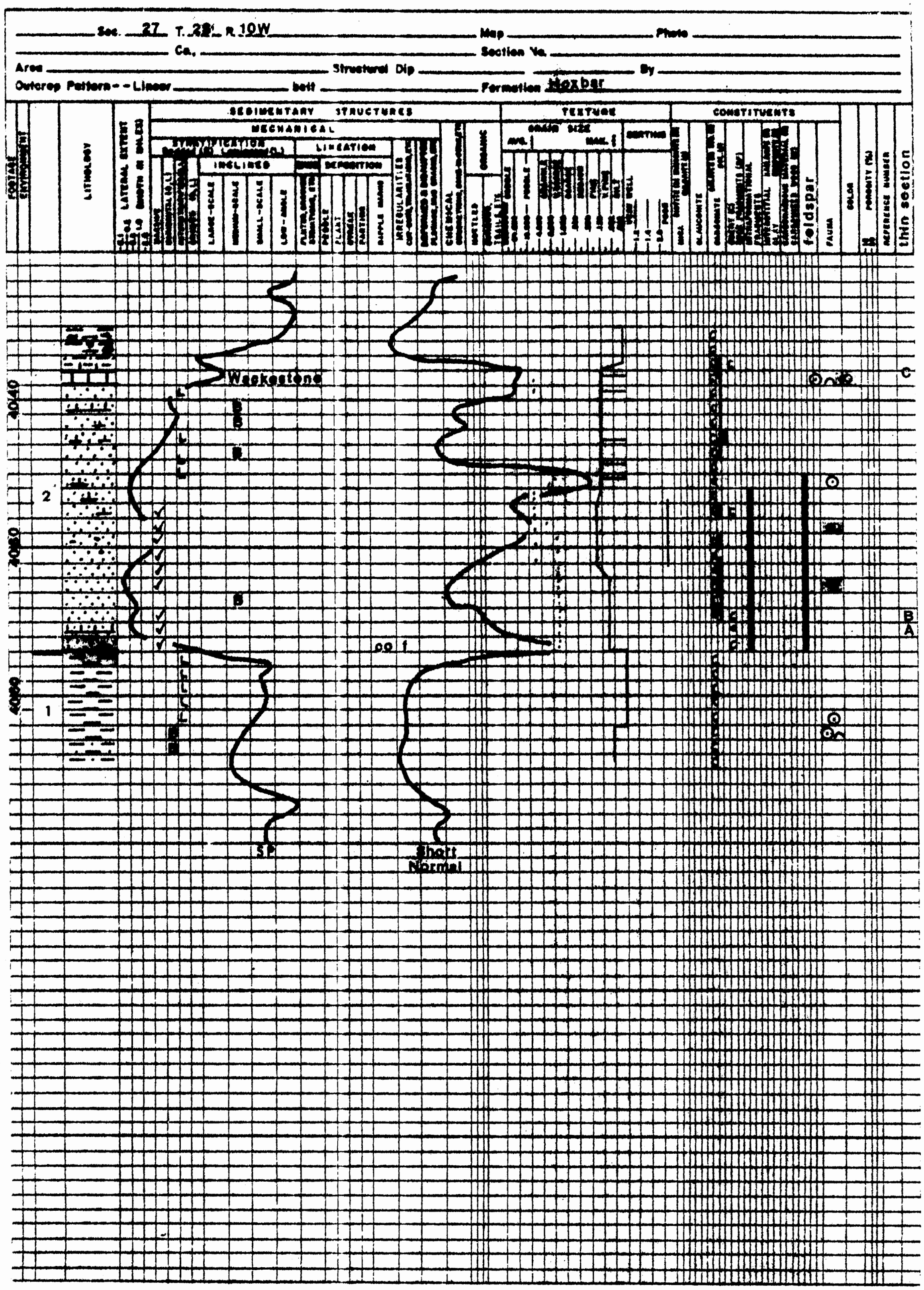


Fig. 19.-Description of core from the Pan American Petroleum, Inc., Phillpott No. 1

stone cemented by calcite. The upper two-thirds of the unit is black mudstone with interlaminated siltsone (Fig. 20). This section of the unit contains trace crinoid stem plates and brachiopod valves; it also is calcite cemented.

Depositional Environment, Unit 1

Unit 1 probably was deposited as part of a lagoonal setting. The fine grain size, color, and shallow-marine fauna suggest this environment.

Internal Features, Unit 2 (Fig. 19)

Sedimentary Structures. Unit 2 is massively bedded with zones of interlaminated sandstone and shale, and medium-scale cross-bedding. Stylolites are throughout the middle section of the unit.

Texture and Constituents. Rocks in Unit 2 range from wackestone (biomicrite) to calcarenaceous sandstone (Pettijohn and others, 1972, p. 232). Grain size in the unit ranges from coarse granules (intraformational fragments) to silt and clay (interlaminated mudstone). These two rock types grade into each other within several cycles. Sorting in the limestones and sandstones is poor. Feldspar, mudstone clasts (intraformational fragments), and rounded chert are minor constituents.

Biota. Crinoid stem plates, brachiopod fragments, and echinoid spines are contained. A fusulinid from this unit has been identified tentatively by Dr. John D. Naff as being Fusulina; this indicates that the unit could be Desmoinesian (Moore and others, 1952).

Fig. 20.-Sharp contact between underlying black shale (unit 1) and calc-arenaceous sandstone (unit 2); from Pan American Petroleum, Inc., Philpott No. 1, depth 4073 ft

Depositional Environment, Unit 2

The thickness, texture, and composition of Unit 2 suggest deposition in a near-shore environment, possibly delta-influenced. The unit also could have been deposited in some form of tidal delta. The sequence is capped by a bed that seems to be pedogenic caliche developed in red and black mudstones, suggesting subaerial exposure in a semiarid climate (James, 1972).

APPENDIX B

EXPLANATION OF PLATES 13, 14, AND 15

Bit cuttings from three wells in Texas were logged because cores were not available from the Texas portion of the study area. Descriptions are shown in Plates 13, 14 and 15; locations of the wells are shown in Plate 18. The information obtainable from bit-cuttings is much less than can be gotten from cores, but the cuttings do give opportunity to compare the rock to its electric-log response. Conclusions drawn from the bit-cutting descriptions are presented in various parts of the text.

APPENDIX C

ANALYSES OF SURFACE SAMPLES

LAB REPORT

OKLAHOMA STATE UNIVERSITY
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STILLWATER, OKL. 74074

LAB-ID ______ SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

CALL NO. ______ CERTIFY SIGNATURE [signature]

*Less than

BFEC SAMPLE NO. MGY	335	336	337	338	339	340	341	342	343	344
LAB SAMPLE NO.	71/9	72/1	82/2	82/3	82/20	82/21	82/22	82/23	82/24	82/25
U_3O_8 R (ppm)	2.70	1.04	539.2	74.12	36.92	2.87	45.82	4.05	1.38	1.90
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)										
LOI S, SS (%)										
MEA (ppm)										
Ag	0	0	0	0	0	0	0	0	0	0
Al	61500	36300	13300	40200	59800	31800	54400	28000	29800	27500
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	*10	20	*10	*10	*10	30	20	*10	*10	*10
Ba	460	40	0	80	120	220	340	180	180	140
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	2400	102900	74900	101500	3700	107100	73400	105700	5400	105900
Co	8	7	5	11	9	8	9	5	3	7
Cr	7	6	6	11	10	9	13	7	5	6
Cu	9	7	35	4100	4100	28	18	12	47	32
Fe	1800	2600	121300	13000	13300	nd	15100	nd	1300	nd
La	14	23	45	14	23	43	18	nd	13	15
Li	24	22	11	22	18	14	28	12	15	15
Mn	1310	9970	8210	14500	8520	11690	9430	11950	6480	6350
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	11900	7900	7400	7700	10200	9400	11500	11100	9400	2300
Nb	34	26	19	22	28	28	27	28	33	26
Ni	10	11	9	14	8	9	11	11	6	10
Pb	15	30	30	20	15	20	15	15	5	20
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	7
Sc	2	35	23	47	6	33	24	37	nd	23
Sn	*5	10	*8	13	*5	10	*6	*10	*5	*8
Sr	30	185	150	700	30	187	178	265	45	88
Ti	3200	1600	1400	2100	3200	1700	3700	1500	1800	1500
V	30	30	35	65	42	30	50	5	10	40
W	*10	*10	*10	*10	*10	*10	*10	10	*10	*10
Y	30	26	19	22	26	25	50	24	28	25
Zn	32	28	35	34	27	55	30	19	24	47
Zr	710	167	104	124	420	610	507	310	323	355

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LAB REPORT

LAB-ID ______________ SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	345	346	347	348	349	350	351	352	353	354
LAB SAMPLE NO.	82/26	82/27	82/28	82/29	82/31	82/32	82/32	82/33	82/34	85/1
U_3O_8 R (ppm)	2.83	1.30	2.02	0.84	8.44	2.03	2.25	2.29	1.34	2.53
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)										
LOI S, SS (%)										
MEA (ppm)										
Ag	0	0	0	0	0	0	0	0	0	0
Al	48300	28100	34100	34100	26900	34200	40900	38900	72300	23900
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	*10	30	*10	*10	*10	10	*10	*10	*10	*10
Ba	220	440	240	180	100	220	140	80	140	100
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	79800	97900	105500	107600	97200	108500	96300	100300	3300	106700
Co	5	5	5	4	4	4	7	6	5	4
Cr	6	7	9	6	11	8	9	10	8	13
Cu	27	6	33	6	17	12	13	8	16	8
Fe	nd	nd	nd	2800	9600	nd	10000	2900	11800	2000
La	21	3	19	40	17	15	51	18	27	35
Li	18	13	11	16	34	15	27	17	25	13
Mn	8440	12510	12850	12380	15790	10330	15360	10950	1030	10450
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	11400	10000	7400	10100	10200	10100	6700	10700	10800	11000
Nb	28	26	31	28	28	27	18	26	32	28
Ni	10	8	16	12	12	5	12	5	7	8
Pb	45	30	20	30	20	15	20	10	10	20
Sb	*5	*5	*5	*5	*5	*5	13	*5	*5	*5
Sc	35	18	33	31	31	32	44	28	6	35
Sn	*6	*10	*6	40	*10	*10	13	*10	*5	*10
Sr	235	310	210	205	380	168	1496	265	25	290
Ti	2600	1400	1900	1400	2700	1700	1600	1800	3600	2200
V	25	30	10	5	25	15	40	0	25	5
W	*10	*10	*10	*10	*10	10	*10	*10	*10	*10
Y	28	24	28	28	23	28	22	25	29	24
Zn	36	22	15	19	24	20	34	21	36	15
Zr	350	186	600	127	318	435	49	562	618	753

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CALL NO. ____________ CERTIFY SIGNATURE [signature]

*Less than

BFEC SAMPLE NO. MGY	355	356	357	358	359	360	361	362	363	364
LAB SAMPLE NO.	85/2	85/3/1	85/3/2	85/4	85/5/1	85/5/2	85/6	85/7	85/8	85/9
U_3O_8 R (ppm)	3.12	1.79	7.97	2.28	12.71	5.56	4.86	1.62	1.11	1.40
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)										
LOI S, SS (%)										
MEA (ppm)										
Ag	0	0	0	0	0	0	0	0	0	0
Al	26300	37500	38700	45700	98000	50000	41700	63500	27800	32200
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ba	200	200	100	400	100	80	280	60	160	220
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	97500	102400	97000	106800	4000	10000	97500	2300	106800	96800
Co	6	4	8	6	8	7	5	6	7	5
Cr	15	8	9	8	12	9	8	6	9	9
Cu	52	10	11	37	225	167	14	11	41	41
Fe	300	nd	9900	3500	27300	17300	2900	4600	1200	800
La	16	35	37	37	30	74	5	23	19	19
Li	35	16	21	19	45	22	15	19	26	14
Mn	15390	11600	14560	9780	290	10950	10820	520	12350	16720
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	119000	112000	10500	10100	11700	10200	9500	13100	8500	9200
Nb	22	29	23	28	34	34	27	34	23	20
Ni	10	11	11	10	13	7	3	9	14	13
Pb	20	0	15	20	10	10	40	20	25	20
Sb	*5	*5	*5	*5	*5	*5	*10	*5	*5	*5
Sc	51	29	56	35	10	30	58	2	34	36
Sn	12	*10	13	*10	*5	*10	14	*5	*10	*10
Sr	1550	150	720	265	10	187	659	10	30	215
Ti	1400	2200	1700	1800	5500	2300	1400	2800	1600	1500
V	10	30	40	30	70	45	35	20	25	15
W	*10	*10	*10	*10	*10	*10	10	*10	*10	*10
Y	24	26	28	30	34	31	33	30	22	18
Zn	22	21	31	73	44	29	24	73	33	21
Zr	133	580	91	265	698	355	121	300	452	226

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LAB REPORT

LAB-ID OKLAHOMA STATE UNIVERSITY, STILLWATER, OKL. 74074 SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

CALL NO. ________ CERTIFY SIGNATURE [signature]

*Less than

BFEC SAMPLE NO. MGY	365	366	367	368	369	370	371	372	373	374
LAB SAMPLE NO.	85/10	85/11	85/12	85/13	85/14	85/15	85/16	85/17	85/18	85/19
U_3O_8 R (ppm)	2.69	2.09	4.33	9.35	4.04	1.57	7.80	1.73	72.21	3.52
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)										
LOI S, SS (%)										
MEA (ppm)										
Ag	0	0	0	0	0	0	0	0	0	0
Al	95400	46900	100600	39300	23500	51100	97200	43400	43700	50900
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	*10	*10	*10	*10	*10	*10	*10	*10	30	*10
Ba	20	80	160	200	80	120	40	160	60	60
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	2400	100700	7000	95100	100600	3700	6100	101600	107200	10300
Co	10	6	18	8	5	7	11	5	7	6
Cr	11	9	17	24	9	7	16	7	10	16
Cu	10	30	14	14	19	14	177	6	518	53
Fe	35500	7800	35900	2100	1300	2600	28300	3700	64600	25500
La	38	25	45	37	24	8	38	14	45	31
Li	53	18	89	17	11	19	38	17	25	17
Mn	150	19200	700	17520	16260	11920	9150	6790	11990	19460
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	9800	9100	10000	9500	10100	10000	9800	10600	7700	9200
Nb	22	19	22	21	19	25	29	20	13	20
Ni	21	10	26	10	11	9	17	9	22	14
Pb	20	20	10	20	30	10	15	15	35	10
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	11	11	15	24	35	3	12	23	34	11
Sn	*5	*8	*5	*8	*10	*5	*5	*8	40	*5
Sr	10	210	15	140	220	78	15	110	200	20
Ti	6000	2200	6700	3200	2200	2900	4600	2300	2100	3300
V	75	30	160	25	10	15	70	25	3030	55
W	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Y	20	17	20	23	17	23	23	17	13	20
Zn	*5	87	95	24	19	25	64	22	45	26
Zr	293	227	209	2496	948	302	1194	246	104	959

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LAB REPORT

LAB-ID STILLWATER, OKL. 74074 SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

CALL NO. ______ CERTIFY SIGNATURE [signature]

*Less than

BFEC SAMPLE NO. MGY	375	376	377	378	379	380	381	382	383	384
LAB SAMPLE NO.	85/20	84/21	85/22	85/23	85/24	85/25	85/26	85/27	85/28	85/50
U_3O_8 R (ppm)	1.88	1.45	2.07	2.53	1.62	2.17	1.13	5.44	1.24	2.65
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)										
LOI S, SS (%)										
MEA (ppm)										
Ag	0	0	0	0	0	0	0	0	0	0
Al	70500	78600	89100	45400	69200	46100	27000	38500	60100	67000
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	20	*10	*10	*10	10	*10	*10	*10	*10	*10
Ba	260	180	300	720	80	140	160	300	760	240
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	3200	3100	26200	4100	2300	107500	97300	96100	66300	105800
Co	6	8	6	5	5	5	5	6	6	6
Cr	8	7	11	9	7	7	5	10	7	10
Cu	28	40	15	48	40	22	7	13	32	19
Fe	6600	22000	14800	10000	5100	1200	1700	12300	nd	4800
La	6	24	24	17	7	17	39	24	28	31
Li	24	24	33	19	21	16	13	37	11	22
Mn	1120	12510	390	17640	350	11640	18000	22650	15590	10750
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	9200	8000	10100	11300	10300	10600	8500	8800	8400	9000
Nb	25	22	22	21	20	25	17	15	21	20
Ni	12	16	14	8	6	4	5	8	4	4
Pb	20	15	10	10	15	15	40	30	20	30
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	4	7	11	9	3	30	38	43	28	32
Sn	*5	*5	*5	*5	*5	*10	10	11	*10	*10
Sr	30	15	25	155	30	155	220	880	250	190
Ti	3300	2900	4600	2700	3100	3100	1100	2200	1500	2800
V	40	50	70	80	35	40	22	65	40	55
W	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Y	19	18	20	20	18	20	16	16	15	20
Zn	34	32	36	22	95	20	16	31	14	32
Zr	428	163	342	474	301	340	60	76	197	348

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STILLWATER, OKL. 74074

LAB REPORT

LAB-ID ______ SUBCONTRACT NO. BFEC 78-131-EPII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	385	386	387	388	389	390	391	392	393	394
LAB SAMPLE NO.	71/1	71/2	71/3	71/4	71/5	71/6	71/7	71/8	71/10	71/11
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	2.69	2.90	2.62	3.47	2.10	3.03	2.04	2.95	2.89	2.22
LOI S, SS (%)										
MEA (ppm)										
Ag	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Al	75000	60200	89200	96300	54900	76900	51600	97800	93600	63300
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	50	50	70	50	50	80	40	40	70	55
Ba	650	100	100	300	450	150	100	100	300	300
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	44600	5400	14100	10500	30300	15700	8300	3400	100	11700
Co	6	6	10	9	6	7	3	7	9	2
Cr	19	13	27	24	11	24	7	17	21	11
Cu	20	17	20	20	14	16	12	22	30	15
Fe	23600	14900	38900	34500	10000	33300	7700	28700	36400	14300
La	27	50	50	17	35	32	10	39	51	19
Li	36	20	58	39	17	46	14	40	40	22
Mn	170	190	180	100	270	150	120	150	580	170
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	4000	6600	3100	4200	5700	8700	6100	4600	4300	5800
Nb	31	34	31	32	31	29	32	32	31	32
Ni	5	7	19	14	9	16	10	9	10	12
Pb	30	10	*10	30	30	15	20	10	30	30
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	16	5	15	13	7	10	2	10	12	5
Sn	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sr	145	100	40	50	165	210	90	30	50	70
Ti	4700	4300	5900	5900	3600	4900	2800	4500	4700	3600
V	45	50	70	100	60	70	35	100	80	35
W	*10	*10	*10	*10	*10	*10	30	30	*10	*10
Y	28	29	29	32	27	27	27	30	31	28
Zn	49	38	55	48	34	57	24	52	43	34
Zr	459	646	349	494	547	411	509	644	522	457

OKLAHOMA STATE UNIVERSITY
DEPT. OF GEOLOGY
PHYSICAL SCIENCE II - RM. 151
STILLWATER, OKL. 74074

LAB REPORT

LAB-ID ______ SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	395	396	397	398	399	401	402	403	404	405
LAB SAMPLE NO.	71/12	71/13	71/14	82/7	82/8	82/36	82/37	82/38	82/39	82/40
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	3.11	2.89	2.22	3.16	3.30	3.17	3.06	2.98	3.17	3.21
LOI S, SS (%)										
MEA (ppm)										
Ag	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Al	95900	78000	82500	61000	55000	64900	67400	66600	62900	68900
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	90	80	60	60	3	50	80	30	60	50
Ba	200	500	400	400	300	400	300	200	200	200
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	9600	9500	58500	5530	2900	6700	10900	9200	7000	21700
Co	10	4	*10	5	8	7	3	9	4	4
Cr	19	17	30	10	7	12	14	14	13	14
Cu	18	23	17	9	6	14	17	19	16	15
Fe	32000	23400	30300	9900	6700	12500	18900	18500	15400	18500
La	48	38	76	128	16	23	23	25	29	31
Li	31	35	54	24	18	17	30	31	29	28
Mn	850	500	180	120	90	210	310	240	340	270
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	4400	6100	5300	4380	7900	7000	6200	5300	7600	50000
Nb	31	32	27	35	34	32	33	31	34	32
Ni	14	16	13	15	9	4	12	6	5	8
Pb	40	25	30	30	15	20	30	10	30	20
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	13	9	20	3	2	4	8	7	6	10
Sn	*5	*5	*7	*5	*5	*5	*5	*5	*5	*5
Sr	30	70	110	125	130	100	110	50	120	85
Ti	4600	4700	4800	3910	3700	3900	4500	4600	4700	4300
V	60	50	90	80	40	120	70	70	80	70
W	*10	*10	20	*10	*10	20	*10	*10	*10	*10
Y	33	30	26	32	29	32	29	30	30	29
Zn	47	71	72	32	30	39	31	39	40	54
Zr	586	510	267	894	727	707	608	631	693	759

OKLAHOMA STATE UNIVERSITY
DEPT. OF GEOLOGY
PHYSICAL SCIENCE II - RM. 151
STILLWATER, OKL. 74074

LAB REPORT

LAB-ID OKLAHOMA STATE UNIVERSITY, DEPT. OF GEOLOGY, PHYSICAL SCIENCE II - RM. 151, STILLWATER, OKL. 74074 SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	406	407	408	409	410	411	412	413	414	415
LAB SAMPLE NO.	85/29	85/30	85/31	85/32	85/33	85/34	85/35	85/36	85/37	85/38
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	2.85	2.94	2.99	2.65	2.65	2.57	3.17	3.82	2.95	3.33
LOI S, SS (%)										
MEA (ppm)										
Ag	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Al	82700	72900	58000	75700	72300	59900	63300	90100	61600	57800
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	60	50	45	70	40	40	80	40	30	50
Ba	600	400	300	250	200	150	250	200	400	200
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	15900	15900	4100	16000	10800	10900	12700	11600	11900	12000
Co	8	*10	9	7	13	7	6	7	8	10
Cr	21	18	11	18	12	12	14	19	13	13
Cu	25	13	23	29	27	23	20	28	24	21
Fe	25500	22700	10400	25000	12500	11200	17400	22800	11800	11300
La	36	31	13	40	16	18	24	40	20	14
Li	37	31	20	33	23	21	24	34	21	23
Mn	720	270	190	410	210	220	190	180	170	220
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	6600	5900	7200	4100	50000	50000	7200	4500	6800	9300
Nb	31	31	34	34	35	32	32	33	33	36
Ni	14	11	11	14	5	14	11	15	13	17
Pb	10	10	20	20	10	20	20	35	20	30
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	11	9	4	11	5	3	5	8	5	4
Sn	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sr	60	40	85	30	35	0	65	10	80	55
Ti	4900	4500	3700	4600	4000	3600	4500	5400	4200	4000
V	60	40	80	40	50	20	40	75	80	30
W	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Y	29	28	31	30	29	28	30	30	30	30
Zn	52	34	28	57	28	30	38	58	29	29
Zr	419	605	644	432	723	577	691	662	683	778

OKLAHOMA STATE UNIVERSITY
DEPT. OF GEOLOGY
PHYSICAL SCIENCE II - RM. 151
STILLWATER, OKL. 74074

LAB REPORT

LAB-ID ____________ SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	416	417	418	419	420	421	422	423	424	425
LAB SAMPLE NO.	85/39	85/40	85/41	85/42	85/43	85/44	85/45	85/46	85/47	85/48
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	2.85	2.35	2.87	2.74	3.33	3.38	3.01	2.45	3.19	3.31
LOI S, SS (%)										
MEA (ppm)										
Ag	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Al	60800	54800	61400	50700	47600	73200	52700	76100	67400	58200
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	40	40	50	50	70	40	45	75	60	65
Ba	150	150	300	400	200	400	300	200	250	450
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	11200	11700	11200	14600	10700	12300	2700	15700	4600	4600
Co	4	5	7	3	10	8	7	11	12	5
Cr	12	11	9	8	8	15	9	13	11	9
Cu	8	20	12	12	13	24	18	19	18	18
Fe	9500	5300	2200	5600	4700	18100	7100	8400	11100	8700
La	24	3	18	8	10	27	10	20	18	7
Li	20	16	23	15	13	28	17	21	21	20
Mn	160	300	80	90	100	260	130	80	150	180
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	6000	4300	6300	6800	6900	5600	6700	4500	6500	6900
Nb	37	35	33	34	34	36	34	35	34	35
Ni	12	7	14	6	8	8	15	14	8	9
Pb	40	*10	60	10	10	10	20	20	20	20
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	3	3	4	3	*1	7	2	7	4	3
Sn	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sr	90	45	100	150	100	50	90	30	55	80
Ti	3700	3100	3800	2900	3300	4700	3500	3800	4200	3600
V	40	40	55	50	30	20	90	30	45	30
W	50	*10	*10	*10	*10	*10	40	*10	*10	*10
Y	29	28	30	30	29	30	29	28	31	30
Zn	79	33	36	18	29	54	34	44	37	28
Zr	620	635	800	670	849	630	839	621	794	764

OKLAHOMA STATE UNIVERSITY
DEPT. OF GEOLOGY
PHYSICAL SCIENCE II - RM. 151
STILLWATER, OKL. 74074

LAB REPORT

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*Less than

BFEC SAMPLE NO. MGY	426	427	428	429	430	431	·432	433	434	435
LAB SAMPLE NO.	85/49	85/51	85/52	85/53	85/54	85/55	85/56	85/57	85/58	85/59
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	3.19	2.64	3.10	1.63	3.06	3.93	3.32	2.92	3.04	2.59
LOI S, SS (%)										
MEA (ppm)										
Ag	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Al	54700	55600	83500	4700	82600	57100	49600	61300	56900	48800
As	*2	*2	*2	*2	*2	*2	*2	*2	*2	*2
B	75	70	75	50	80	60	60	50	35	50
Ba	400	300	200	100	300	200	200	400	400	100
Be	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Ca	5700	4800	9800	3000	9800	6400	3900	8300	6000	5500
Co	4	6	5	4	5	6	4	4	5	7
Cr	10	12	17	8	18	10	9	11	10	8
Cu	19	16	21	5	29	31	22	19	14	14
Fe	8600	10000	24100	2700	19800	9000	5800	11700	8900	5200
La	15	12	43	39	36	12	3	16	8	2
Li	20	20	37	15	36	17	14	21	18	15
Mn	140	190	160	180	240	260	100	190	160	260
Mo	*10	*10	*10	*10	*10	*10	*10	*10	*10	*10
Na	8100	6300	5400	4400	5500	4300	4900	5200	6300	5700
Nb	34	34	34	35	33	36	34	34	32	33
Ni	7	12	11	9	17	4	4	6	10	8
Pb	25	30	10	25	40	30	45	20	20	20
Sb	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sc	3	4	10	*1	9	4	*2	4	3	*2
Sn	*5	*5	*5	*5	*5	*5	*5	*5	*5	*5
Sr	120	100	50	75	50	80	100	120	110	130
Ti	3600	3600	5000	2400	4800	3300	2900	3900	3300	3000
V	25	90	45	50	30	45	60	75	60	60
W	*10	*10	*10	*10	*10	*10	*10	*10	40	*10
Y	29	29	30	28	30	29	30	30	29	29
Zn	33	27	48	29	49	34	33	49	42	31
Zr	788	600	689	388	476	663	688	721	713	597

OKLAHOMA STATE UNIVERSITY
DEPT. OF GEOLOGY
PHYSICAL SCIENCE II - RM. 151
STILLWATER, OKL. 74074

LAB REPORT

LAB-ID STILLWATER, OKL. 74074 SUBCONTRACT NO. BFEC 78-131-E PII DATE 2/29/80

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*Less than

BFEC SAMPLE NO. MGY	436									
LAB SAMPLE NO.	85/60									
U_3O_8 R (ppm)										
U_3O_8 W (ppb)										
U_3O_8 S, SS (ppm)	3.52									
LOI S, SS (%)										
MEA (ppm)										
Ag	*10									
Al	54600									
As	*2									
B	80									
Ba	400									
Be	*10									
Ca	4400									
Co	8									
Cr	11									
Cu	17									
Fe	9500									
La	20									
Li	21									
Mn	190									
Mo	*10									
Na	9300									
Nb	34									
Ni	*10									
Pb	15									
Sb	*5									
Sc	3									
Sn	*5									
Sr	110									
Ti	4300									
V	50									
W	30									
Y	31									
Zn	28									
Zr	809									

APPENDIX D

LOCATIONS OF WELLS WITH ANOMALOUS

GAMMA-RAY LOGS

Well Name	Location
1. Cities Service Co., Cantrell No. 14	NW NE 32-1S-8W
2. Landa Oil Co., Rone No. 1	SE NE SE 35-1S-10W
3. Pan American Petroleum Co., Oklahoma "C" No. 1	N½ NW NE 36-2S-10W
4. Cities Service Co., Vardell No. 4	SE SE NW 17-3S-11W

APPENDIX E

LOCATIONS OF LOGS USED IN PREPARATION OF CORRELATION SECTIONS

No.	Operator and Well Number	Location
	West-East Correlation Section A-A'	
1.	J. M. Crofton; Champion No. 1	NE NW NE 31-1S-11W
2.	S. F. Hutcheson; Turner No. 1	NE NW NW 32-1S-11W
3.	Timberlake et al.; Crow No. 1	NE NW NW 5-2S-11W
4.	L. W. Winkler; Lyons No. 1	SW SW SE 3-2S-11W
5.	Kerr-McKee; Be-nah No. 1	SW SW NW 1-2S-11W
6.	Perkins Production; Carr No. 1	SE NW NW 6-2S-10W
7.	J. W. Baldwin; Hilton No. 2	SW NE SE 6-2S-10W
8.	Atkinson et al.; Smith No. 1	SE SE SE 5-2S-10W
9.	Graham Oil; Wiley No. 2	NE NE SW 4-2S-10W
10.	Stanolind Oil; Priddy No. 6	SE NW SE 3-2S-10W
11.	Stanolind Oil; Moore No. 9	S½ NE SW 2-2S-10W
12.	M. Bolles et al.; Huff No. 1	SE NE 1-2S-10W
13.	Kingery Bros.; Walker No. 1	NE SW NW 6-2S- 9W
14.	Kewanee Oil; Taunah No. 10	SW SE NW 32-1S- 9W
15.	Seagel et al.; Rhodes No. 1	SW SW SW 28-1S- 9W
16.	California Co.; Waller No. 1	SW NW NW 26-1S- 9W
17.	Magnolia Oil; Russell No. 1	NW NW SE 25-1S- 9W
18.	Adkins-Chamberlin; Dauthitt No. 1	NW NE SE 30-1S- 8W
19.	Davodor-Davidor; Parker No. 1	SW NE NW 28-1S- 8W
20.	J. P. Ledford; Scott No. 5-A	SE SE 28-1S- 8W
21.	Atkinson et al.; Bullard No. 1	SW NW NE 34-1S- 8W
22.	C. L. McMahon; Miller No. 1	NE NE SE 35-1S- 8W
	West-East Correlation Section B-B'	
23.	G. Grimes; Eslep No. 1	NW NW NE 12-5S-11W
24.	Bridwell Oil; Dyke No. 1	SW NE SW 6-5S-10W
25.	Bridwell Oil; Seward No. 1	SE NW NE 8-5S-10W
26.	Burke Royalty; Warren No. 1	SW SW NW 3-5S-10W
27.	Farris Oil; School Land No. 1	NW SW 29-4S-10W
28.	E. P. Griffin; Malcolm No. 1	SE SE NE 2-5S-10W
29.	J. W. Hastings; Cliff No. 1	SE SW SE 1-5S-10W
30.	J. F. Stephenson; Grover No. 1	SW NE NE 6-5S- 9W
31.	Pitts & Banner; Hight No. 1	SW SE 32-4S- 9W
32.	Mexican Drig.; Boudeton No. 1	NW NW NE 9-5S- 9W
33.	Hunt Oil; Langford No. 1	R. R. Brown Sur., A-14, lot 7
34.	Continental Oil; Crew No. 1	NW NW SE 1-5S- 8W
35.	Bridwell Oil; Settlemires No. 1	SW SW NE 5-5S- 8W
36.	Seaboard Oil; Fisher No. 1	NW NW NE 9-5S- 8W
37.	E. R. Betty; Echols No. 1	NW NW NW 11-5S- 8W
38.	C. Stewart; Guthrie No. 1	SW NW SE 6-5S- 8W
	North-South Correlation Section C-C'	
39.	Lundy & Shear; Mullins No. 1	NE SE NW 7-1S- 8W
40.	W. H. Atkinson; Johnson-Clark No. 1	NW NW NW 18-1S- 8W
41.	T. H. McCasland; Reavis No. 1	SW NW SE 24-1S- 9W
42.	Magnolia Petroleum; Russell No. 16	NW NW SE 25-1S- 9W
43.	Jones Oil; School Land No. 6	NW NE 36-1S- 9W

No.	Operator and Well Number	Location
44.	C. W. Scott; Covington No. 1	NW NW SW 6-2S- 8W
45.	Rixlieben et al.; Holt No. 1	NE NE SE 12-2S- 9W
46.	A. Gutowsky; Brooks No. 1	SW SE SW 18-2S- 8W
47.	B. B. Burke; Bull No. 1	SE NE NE 34-2S- 9W
48.	M. Jackson; Carter No. 1	SE SE SE 2-3S- 9W
49.	C. F. Dillingham; State No. 1	SE SE NE 13-3S- 9W
50.	Ryan & Hayes; Willanon No. 1	C NW SE 23-3S- 9W
51.	Samedan Oil; Newberry No. 1	C SW SE 26-3S- 9W
52.	Fidelity Royalty; Cover No. 1	C NW SE 3-4S- 9W
53.	F. Couin; Foster No. 1	C NW SE 27-4S- 9W
54.	M. T. McLaughlin; Cofer No. 1	SW SE SW 26-4S- 9W
55.	F. Gouin et al.; Fitzgerald No. 1	SE SE SW 35-4S- 9W
56.	Hunt Oil; Langford No. 1	R. R. Brown Sur. A-14, lot 7
57.	Daube Co.; Langford No. 1	R. R. Brown Sur. A-14, Henderson Tract
58.	O. M. Pierce; Kennedy No. 1	SE SW SW 25-5S- 9W
59.	Cities Service; Gardner No. 1	SE SE NE 36-5S- 9W
60.	Mack Oil; McMenamy No. 1	NW NW NW 7-6S- 8W

APPENDIX F

LOCATIONS OF LOGS USED IN PREPARATION OF STRATIGRAPHIC SECTION

No.	Operator and Well Number	Location
	Northwest-Southeast Stratigraphic Section N-N'	
1.	Oil Capital; Hoodenpyle No. 1	NW NW SE 23-1S-11W
2.	Bridwell Oil; Berendzen No. 1	NW SW SW 25-1S-11W
3.	Republic Nat'l Gas; McMullen No. 1	NE NE SW 36-1S-11W
4.	Perkins Production; Records No. 6	NE NW SW 6-2S-10W
5.	Pickett; English No. 1	SW SW NE 7-2S-10W
6.	Producers Oil & Gas; Bull No. 1	NE SW SW 8-2S-10W
7.	Johnson et al.; Welden No. 1	SE SE NW 27-2S-10W
8.	Pan American; State 1-C	NW NW 36-2S-10W
9.	Mack Oil; Gardner No. 1	SW SW NE 31-2S- 9W
10.	Jackson Drilling; Carter No. 1	SE SE SE 2-3S- 9W

APPENDIX G

WELLS AND DATA USED IN PREPARATION OF SANDSTONE-PERCENTAGE AND STRUCTURAL GEOLOGIC MAPS

Well name	Location	depth to Megargel, feet below sea level	Interval 2: interval thickness (ft)	Interval 2: total sand (ft)	Interval 2: sand percentage	Interval 2A: interval thickness (ft)	Interval 2A: total sand (ft)	Interval 2A: sand percentage	Interval 1: interval thickness (ft)	Interval 1: total sand (ft)	Interval 1: sand percentage	Interval 1A: interval thickness (ft)	Interval 1A: total sand (ft)	Interval 1A: sand percentage
Goff-Leeper; Crews #1	SE SE NW 2-1S-8W; Stephens Co., OK	2103	3334	637	19	210	82	39	N.P.			240	105	44
Youngblood; Walters #1	SE SE SW 3-1S-8W; "	1845	3060	575	19	N.P			940	688	73	210	33	16
W. H. Atkinson; Johnson #4	NW NE SE 6-1S-8W; "	1749	2830	423	15	195	76	39	N.PEN.			N.PEN.		
Lundy & Shear; Mullins #1	NE SE NW 7-1S-8W; "	1674	2819	496	18	179	81	45	N.PEN.			211	20	9
J. Gray; Merle #1	SE SE SE 8-1S-8W; "	1769	2951	350	12	201	108	54	N.PEN.			201	58	29
Blackstock et al.; Hayes #1	NW NW NE 9-1S-8W; "	1835	3020	457	15	205	49	24	860	500	58	200	17	9
Brunty Prod.; Markham #1	NW NW SW 10-1S-8W; "	1805	3018	768	25	N.P			972	644	66	217	60	28
Westheimer; Barks #1	SE NE SW 11-1S-8W; "	2156	3310	465	14	N.P			915	502	55	N.P.		
T. T. Eason; Sikes #1	SE SW SE 12-1S-8W; "	2237	3334	860	26	214	63	29	N.P.			N.P.		
Crowe Drlg.; Hall #1	NE SE NE 15-1S-8W; "	1744	2930	518	18	200	42	21	N.PEN.			220	83	38
Jones Oil; Blake #9	NE SW SW 16-1S-8W; "	1620	2785	599	22	N.P			875	550	63	193	73	38
Jones Oil; Furst #9	NE SE NW 16-1S-8W; "	1700	2915	655	22	170	50	29	885	634	72	185	65	35
W. H. Atkinson; Van Gieson #1	SW NW NW 17-1S-8W; "	1735	2835	400	14	195	46	24	760	365	48	215	33	15
W. H. Atkinson; Johnson #1	NW NW NW 18-1S-8W; "	1640	2705	424	16	195	115	59	695	332	48	217	10	5
Magnolia Petro.; Worrell #7	SW SW NW 19-1S-8W; "	1235	2325	529	23	175	105	60	N.PEN.			170	70	41
W. H. Atkinson; McClure #1	NE NW SE 19-1S-8W; "	1372	2495	368	15	190	75	40	673	333	49	170	15	9
C. Carter; Cule #6	SE SE NW 20-1S-8W; "	1595	2738	468	17	193	30	16	N.PEN.			N.PEN.		
C. C. Nye; Slover #1	NE SW SE 20-1S-8W; "	1510	2645	367	14	185	48	26	N.PEN.			N.PEN.		
Davis & Stewart; Cohen #1	SW SW SW 21-1S-8W; "	1516	2620	477	18	210	58	28	N.PEN.			N.PEN.		
McMahon, Inc.; Click #1	SE SE NW 23-1S-8W; "	1708	2843	645	23	198	94	47	N.P.			197	34	17
Samson Resources; Clark #1	C NE 25-1S-8W; "	2099				N.P			N.P.			N.P.		
W. N. Hayes et al.; Talor #1	SW SW NW 27-1S-8W; "	1466	2558	656	26	200	77	39	N.PEN.			200	38	19

Well name	Location	depth to Megargel, feet below sea level	Interval 2			Interval 2A			Interval 1			Interval 1A		
			interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage
Davidor; Parker #1	SW NE NW 28-1S-8W; Stephens Co., OK	1500	2605	556	21	195	45	23	N.P.			205	31	15
J. P. Ledfor; Scott #A-5	SE SE 28-1S-8W; "	1349	2419	244	10	209	63	30	N.P.			196	25	13
Guardian Oil; Hamman #1	NE NE NE 29-1S-8W; "	1506	2632	418	16	177	44	25	N.PEN.			N.PEN.		
Adkins; Dauthitt #1	NW NE SE 30-1S-8W; "	1529	2611	351	13	171	48	28	N.PEN.			189	0	0
L. W. Scott; Clark #3	NW NW NW 31-1S-8W; "	1523	2661	345	13	176	57	32	N.PEN.			189	50	26
Cities Service; Cantrell #18	NE SE SE 32-1S-8W; "	1309	2410	504	21	190	38	20	N.PEN.			185	25	14
W. B. Cleary, Inc.; Brown #1	SE NW SW 33-1S-8W; "	1314	2421	442	18	161	43	27	N.PEN.	1		174	5	3
W. H. Atkinson; Bullard #1	SW NW NE 34-1S-8W; "	1392	2476	533	22	176	40	23	N.PEN.			174	33	19
C. L. McMahon; Miller #1	NE NE SE 35-1S-8W; "	1515	2633	552	21	173	48	28	N.P.			170	40	24
W. H. Atkinson; Shorter #1	SE NE SW 1-1S-9W; "	1807	2933	525	18	205	20	10	622	387	62	217	105	48
W. S. Richardson; Gunn #2	SE SW SE 5-1S-9W; Cotton Co., OK	1609	2685	270	10	195	10	5	N.PEN.			220	29	13
Bridwell Oil; Roberts #1	NW NW SE 8-1S-9W; "	1629	2708	270	10	188	40	21	532	185	35	202	47	23
W. H. Atkinson; State #1	NE NE NE 13-1S-9W; Stephens Co., OK	1658	2720	526	19	201	117	58	N.PEN.			210	110	52
Vickers Petro.; Tovetty #1	NE SE NW 14-1S-9W; "	1794	2842	451	16	220	83	38	N.PEN.			173	54	31
T. H. McCasland; Ecovitch #1	NE SE SW 15-1S-9W; "	1734	2765	305	11	195	30	15	635	276	43	175	29	17
T. H. McCasland; Mosley #1	SE NW SE 20-1S-9W; Cotton Co., OK	1647	2700	411	15	200	90	45	N.PEN.			190	20	10
T. H. McCasland; Reavis #1	SW NW SE 24-1S-9W; Stephens Co., OK	1241	2300	287	12	150	15	10	N.PEN.			162	75	46
Magnolia; Russell #16	NW NW SE 25-1S-9W; "	1285	2360	378	16	140	39	28	N.PEN.			190	47	25
California Co.; Waller #1	SW NW NW 26-1S-9W; "	1722	2775	650	23	210	95	45	725	334	46	196	77	39
Jones Oil; School Land #6	NW NE 36-1S-9W; "	1404	2520	293	12	170	12	7	N.PEN.			195	8	4
P. Boyle; Mayes #1	SW SE 2-1S-10W; Cotton Co., OK	1481	2540	139	5	180	36	20	N.PEN.			N.PEN.		
Bolin Oil; Bull #1	NW SE SE 3-1S-10W; "	1385	2465	176	7	170	40	24	N.PEN.			186	0	0

Well name	Location	depth to Megargel, feet below sea level	Interval 2 interval thickness (ft)	Interval 2 total sand (ft)	Interval 2 sand percentage	Interval 2A interval thickness (ft)	Interval 2A total sand (ft)	Interval 2A sand percentage	Interval 1 interval thickness (ft)	Interval 1 total sand (ft)	Interval 1 sand percentage	Interval 1A interval thickness (ft)	Interval 1A total sand (ft)	Interval 1A sand percentage
E. F. Griffin; Khlmann #1	SE SE SE 6-1S-10W; Comanche Co., OK	1339	2460	109	4	172	0	0	N.PEN.			180	0	0
H. A. Harmon; Franklin #1	SW SW NE 10-1S-10W; Cotton Co., OK	1405	2452	155	6	190	45	24	N.PEN.			208	41	20
P. C. Teas; Gunn #1	NW NW NE 14-1S-10W; "	1490	2545	244	10	175	65	37	406	36	9	228	36	16
Harper et al.; Hulen #1	SW SW NE 17-1S-10W; Comanche Co., OK	1385	2480	167	7	180	33	18	N.PEN.			180	0	0
Haper & Turner; Berendzen #1	SE NE NW 19-1S-10W; Cotton Co., OK	1475	2552	180	7	172	46	27	N.PEN.			168	15	9
N. Akin; Urice #6	NE NE SE 22-1S-10W; "	1513	2535	44	2	165	10	6	N.PEN.			195	0	0
Halliburton; Bondurant #1	SW SW SE 23-1S-10W; "	1350	2400	186	8	170	38	22	N.PEN.			180	106	59
Harper-Turner; Carl #1	NW NE SW 27-1S-10W; "	1319	2410	125	5	160	5	3	N.PEN.			160	0	0
Halliburton; Sheppard #1	SE NE NE 28-1S-10W; "	1356	2430	169	7	180	38	21	N.PEN.			170	48	28
Bridwell Oil; Hoodenpyle #1	SE SE SE 30-1S-10W; "	1545	2623	174	7	173	49	28	N.PEN.			182	13	7
D. H. Bolin; Devine #1	SE NE NE 14-1S-11W; Comanche Co., OK	1224	2282	189	8	177	29	16	531	28	5	183	28	15
D. H. Bolin; Hobo #1	SE SE SW 14-1S-11W; "	1294	2380	122	5	190	5	3	N.P.			172	23	13
Oil Capital; Hoodenpyle #1	NW NW SE 23-1S-11W; "	1372	2440	167	7	165	30	18	470	62	13	195	34	17
Bridwell Oil; Berendzen #1	NW SW SW 25-1S-11W; Cotton Co., OK	1457	2524	115	5	187	53	28	484	45	9	206	0	0
J. M. Crofton; Champion #1	NE NW NE 31-1S-11W; "	1046	2070	147	7	175	10	6	N.PEN.			217	36	17
Kingery Bros.; MacMahon #1	NW NW NW 33-1S-11W; "	1116	2160	207	10	160	38	24	N.PEN.			190	16	8
Bridwell Oil; Holcomb #1	SE NE SE 35-1S-11W; "	1488	2485	174	7	200	77	39	N.PEN.			N.PEN.		
Fitzgerald & Webb; Trout #1	SE NE SW 1-2S-8W; Stephens Co., OK													
Fitzgerald & Webb; Trout #2	NE SW SW 1-2S-8W; "													
Pace Petro. Corp.; Gilsworth #5	SW SW NW 2-2S-8W; "	1365	2411	573	24	238	91	38	409	174	43	179	28	16
T. H. McCasland; Pitts #1	SW SW SE 3-2S-8W; "	1501	2573	353	14	238	91	38	397	114	29	147	0	0
T. H. McCasland et al.; Woodward #1	SW NW SE 4-2S-8W; "	1501	2593	510	20	220	76	35	397	101	25	205	3	1

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			interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage
C. W. Scott; Covington #1	NW NW SW 6-2S-8W; Stephens Co., OK	1750	2821	388	14	203	66	36	N.PEN.			229	37	16
Beach & Talbot; Trantham #1	NW SW NE 8-2S-8W; "	1644	2703	512	19	223	57	26	N.PEN.			217	63	29
Christie-Stewart; Montgomery #1	NE NW SE 11-2S-8W; "	1142	2230	542	24	180	85	47	N.PEN.			212	61	28
T. H. McCasland; Tomlinson #1	N½ SE 12-2S-8W; "	1203	2300	642	28	188	108	57	420	286	68	178	155	87
T. H. McCasland; Woodward #1	NW NW NE 14-2S-8W; "	1159	2203	496	23	N.P.			507	216	43	222	118	53
A. Gutowsky; Brooks #1	SW SE SW 18-2S-8W; "	1771	2756	498	18	186	37	20	N.PEN.			N.PEN.		
Stoner & Cummings; Miller #1	SE NW NE 20-2S-8W; "	1763	2820	625	22	200	66	33	N.PEN.			N.PEN.		
W. H. Atkinson; McCutchin #1	NW SE SW 22-2S-8W; "	1763	2837	723	25	207	81	39	478	272	57	227	129	57
L. E. Jones Prod.; Taylor #1	C SE SW 23-2S-8W; "	1656	2654	615	23	183	70	38	386	107	28	221	30	14
California Co.; Brooks #1	NE NW SE 27-2S-8W; "	1715	2735	611	22	200	70	35	525	251	48	220	93	42
Pan Am Petro.; Apple #1	C SW NW 34-2S-8W; "	1905	2942	523	18	187	23	12	473	196	41	240	85	35
Davon Oil; Simmons #1	NW NW SW 35-2S-8W; "	1868	2860	721	25	200	52	26	503	208	41	230	100	43
Halliburton; Bordner #1	NE SE NW 1-2S-9W; "	1482	2582	538	21	202	79	39	N.PEN.			198	73	37
H. Pickett; Choc-poy-ah #1	SW SW NW 5-2S-9W; Cotton Co., OK	1848	2855	419	15	215	75	35	N.PEN.			185	47	25
Kingery Bros.; Walker #1	NE SW NW 6-2S-9W; "	1788	2770	527	19	200	82	41	N.PEN.			200	64	32
Vaggoe Oil; Jones #1	NE NE NE 11-2S-9W; Stephens Co., OK	1780	2900	558	19	200	65	33	N.P.			225	68	30
Cameron & Dunlap; Johnson #1	NW NE NW 12-2S-9W; "	1731	2802	581	21	172	46	27	698	332	48	228	48	21
Rixleben; Holt #1	NE NE SE 12-2S-9W; "	1728	2773	513	18	175	24	14	N.PEN.			N.PEN.		
P. C. Teas; Norman #1	C SE NW 19-2S-9W; Cotton Co., OK	1881	2913	365	13	208	40	19	577	333	58	207	93	45
Stanolind Oil; Moore #9	NE SW 2-2S-10W; "	1691	2743	466	17	183	100	55	717	293	41	195	98	50
J. W. Baldwin; Oldis #1	SW NE SE 6-2S-10W; "	1562	2594	382	15	194	110	57	N.PEN.			194	83	43
C. E. McCaughey; Meyers #1	SW SW NW 17-2S-10W; "	1617	2650	402	15	195	80	41	792	202	26	190	95	50

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Howell-Howell; Kennedy #1	SE SE NW 18-2S-10W; Cotton Co., OK	1556	2540	437	17	185	120	65	N.PEN.			N.PEN.		
Kingery Bros.; Pickett #1	NW NW NW 20-2S-10W; "	1513	2500	412	16	172	83	48	N.PEN.			N.PEN.		
Johnson & Alco; Welden #1	SE SE NE 27-2S-10W; "	1718	2798	424	15	181	75	41	884	214	24	197	61	31
Norman & Graham; Smith #1	SE SE SE 28-2S-10W; "	1558	2580	361	14	177	83	47	840	251	30	183	28	15
J. B. Russell; Wisely #1	SW NW NW 28-2S-10W; "	1515	2525	323	13	175	65	37	N.PEN.			185	38	21
Crowe Drlg. Co.; Johns #1	NW NE SE 29-2S-10W; "	1514	2504	401	16	166	48	29	N.PEN.			N.PEN.		
J. W. Baldwin; Rogers #1	NE NW NW 29-2S-10W; "	1500	2464	341	14	174	78	45	N.PEN.			N.PEN.		
Kerr-McGee; Be-nah #1	SW SW NW 1-2S-11W; "	1496	2491	468	19	171	105	61	491	156	32	209	49	29
L. W. Winkler; Lyons #1	SW SW SE 3-2S-11W; "	1367	2356	230	10	163	93	57	N.PEN.			184	20	11
Timberlake et al.; Crow #1	NW NW NW 5-2S-11W; "	1100	2139	157	7	179	31	17	N.PEN.			N.PEN.		
P. B. Scott; Smith #1	NW NW NE 7-2S-11W; "	1164	2240	271	12	130	70	54	N.PEN.			N.PEN.		
Carter Oil; Reynolds #1	C SW NE 8-2S-11W; "	1253	2340	295	13	152	75	49	410	53	13	155	3	2
R. B. Ross et al.; Patterson #1	NW NW SE 9-2S-11W; "	1276	2350	385	16	160	115	72	N.PEN.			N.PEN.		
Jackson-Davenport; English #1	SW SW SE 12-2S-11W; "	1484	2500	300	12	160	72	45	N.PEN.			N.PEN.		
Kewanee Oil; Caddo #1	NW SW NE 13-2S-11W; "	1406	2422	257	11	159	92	58	N.PEN.			N.PEN.		
Gandy Drlg. Co.; Clayburn #1	NW NW SW 15-2S-11W; "	1446	2280	406	18	160	50	31	N.PEN.			N.PEN.		
S. D. Johnson; Thomas #1	NW NE NW 17-2S-11W; "	1239	2340	337	14	150	100	66	N.PEN.			N.PEN.		
E. G. Whisnand; Coody #1	SE SE NE 17-2S-11W; "	1263	2318	316	14	148	95	64	N.PEN.			N.PEN.		
Griffin & Barbre; Schazel #1	SW SW NE 19-2S-11W; "	1227	2280	342	15	170	98	58	N.PEN.			N.PEN.		
Strother Bros.; High #1	C NE SE 20-2S-11W; "	1238	2344	422	18	154	72	47	N.PEN.			170	70	41
D. L. Jobe; Parish #1	NW NW SE 31-2S-11W; "	1100	2133	346	16	183	68	37	N.PEN.			N.PEN.		
Kingwood Oil; State School Land #1	NE NE NE 33-2S-11W; "	1274	2320	484	21	197	114	58	N.PEN.			N.PEN.		

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Peterman-Starrett; High #1	NW NW NW 35-2S-11W; Cotton Co., OK	1320	2325	299	13	156	40	26	N.PEN.			170	30	18
Ferris; School Land #1	SE SE NW 36-2S-11W; "	1347	2342	318	14	164	94	57	N.PEN.			182	49	30
Strother Bros.; State #2	SE SE NE 16-3S-8W; Stephens Co., OK	1770	2830	562	20	200	3	2	501	161	32	230	65	28
M. Jackson; Carter #1	SE SE SE 2-3S-9W; "	1876	2877	378	13	230	53	23	N.PEN.			N.PEN.		
C. F. Dillingham; State #1	SE SE NE 13-3S-9W; "	1710	2650	652	25	200	35	18	N.PEN.			N.PEN.		
Meredith Drig.; Bull #1	NW NW SE 20-3S-9W; Cotton Co., OK	1361	2385	405	17	180	63	35	N.PEN.			N.PEN.		
Ryan & Hayes; Willianon #1	C NW SE 23-3S-9W; Jefferson Co., OK	1407	2378	644	27	178	20	11	N.PEN.			N.P.		
[illegible] Oil; Newberry #1	C SW SE 26-3S-9W; "	1217	2328	411	18	168	60	36	N.P.			203	51	25
C. V. Richardson; Jones #1	SW NE 9-3S-10W; Cotton Co., OK	1367	2347	376	16	187	113	60	N.PEN.			N.PEN.		
Stanolind Oil; Jones #1	C SE NE 11-3S-10W; "	1517	2577	502	19	177	15	8	453	111	25	208	30	14
Smith et al.; Husted #1	NW NW SE 18-3S-10W; "	1147	2088	215	10	213	83	39	N.PEN.			195	110	56
Killingsworth; Bost #1	NW NW NW 23-3S-10W; "	1341	2382	286	12	160	10	6	N.PEN			N.PEN.		
Bridwell Oil; Halsky #1	SW SE NW 30-3S-10W; "	915	1848	520	28	158	91	58	603	283	47	177	88	50
Kingwood Oil; Oma Dugan #1	NE NE SW 1-3S-11W; "	1258	2258	406	18	N.P.			N.P.			187	85	45
A. Kriss; A. E. Cain #1	SW NW NE 3-3S-11W; "	1106	2120	445	21	154	98	63	N.PEN.			166	110	66
Bridwell; Coffer #1	NE NE SW 5-3S-11W; "	999	2045	266	13	175	50	29	N.PEN.			174	21	12
Frankfort Oil; Phillips #1	SW SW SE 6-3S-11W; "	1006	2050	226	11	130	55	42	635	136	21	N.P.		
Androde III; Tallett #1	SE SE NE 7-3S-11W; "	835	1851	227	12	178	46	26	N.PEN.			N.PEN.		
Nat'l Assoc. Petro.; Phillips #7	NW SE SW 8-3S-11W; "	1015	2034	499	25	186	94	50	N.PEN			N.PEN.		
Norman & Graham; Fletcher #1	NE NE NW 11-3S-11W; "	1073	2065	454	22	169	103	60	N.PEN			N.PEN.		
Wilcox Oil; Virginia #1	NW SE SW 13-3S-11W; "	1110	2102	399	19	172	85	49	N.PEN.			N.PEN.		
Bridwell Oil; Houghton #1	SE SE SW 14-3S-11W; "	1002	1990	478	24	N.P.			670	211	31	178	50	28

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Bridwell Oil; Shaw #1	SE NE SW 15-3S-11W; Cotton Co., OK	960	1969	453	23	151	84	56	653	249	38	161	66	41
Burton; Branch #1	NW SW NW 18-3S-11W; "	958	1910	287	15	152	81	53	N.PEN.			N.PEN.		
Halliburton et al.; Sau-with-ky #1	SW NE SE 19-3S-11W; "	1020	1977	339	17	N.P.			N.PEN.			N.PEN.		
Cities Service; Butler #1	SW NE NW 20-3S-11W; "	993	2000	540	27	155	123	79	N.PEN.			N.PEN.		
Cities Service; Phillips C #1	NE SW SE 20-3S-11W; "	986	1993	478	24	158	134	85	N.PEN.			N.PEN.		
Akin & Dimock; Wolf #1	NE SW 21-3S-11W "	961	2007	195	10	176	70	40	N.PEN.			N.PEN.		
Bridwell Oil; Houghton #2	SW NW NW 23-3S-11W; "	909	1892	530	28	N.P.			643	161	25	221	47	21
R. Fisher; Butler #1	SW SW SE 24-3S-11W; "	941	1875	506	27	140	66	47	N.PEN.			175	99	56
Bridwell; Kopart #3	C SE NW 25-3S-11W; "	888	1859	316	17	169	81	47	N.PEN.			N.PEN.		
Kingwood Oil; Al Sellers #1	SW NW NW 27-3S-11W; "	909	1948	351	18	170	85	50	N.PEN.			156	65	42
E. Halliburton; Eschler #2	NE NE SE 29-3S-11W; "	917	1930	317	16	160	86	54	N.PEN.			N.PEN.		
Kerr-McGee; Soloman #1	NE NE SW 29-3S-11W; "	924	1923	275	14	151	65	43	N.PEN.			N.PEN.		
Mann & Halliburton; Che-so-wy #1	NW NW NE 30-3S-11W; "	1016	1967	382	19	152	70	46	N.PEN.			N.PEN.		
Stedmaker & Williams Oil; A. Eschlec	SW SW NE 31-3S-11W; "	1311	2254	518	23	166	108	65	N.PEN.			N.PEN.		
Phillips Petro.; Cache #2	NW SW NE 33-3S-11W; "	926	1921	615	32	N.P.			676	240	36	173	68	39
T. H. McCasland; Henderson #1	NE SW NE 34-3S-11W; "	885	1886	368	20	134	40	30	N.PEN.			N.PEN.		
Bridwell Oil; School Land #C-1	N½ NE NE 36-3S-11W; "	858	1783	374	21	157	63	40	N.PEN.			N.PEN.		
Gaskill; Hight #1	NW NE SW 7-4S-8W; Jefferson Co., OK	1052	2058	647	31	200	73	37	N.PEN.			183	50	27
Sullivan Bros. Drlg.; Melton #1	SE SE NW 8-4S-8W; "	1029	1937	450	23	N.P.			466	242	52	N.P.		
W. H. Deckham; Sanders #1	NW NW NE 10-4S-8W; "	1101	2093	543	26	N.P.			551	125	23	N.P.		
Continental Oil; Strat Test AA106	SE SE SW 22-4S-8W; "	886	1803	276	15	N.P.			517	151	29	N.P.		
Bell Oil & Gas; Bartling #1	NE NE SE 28-4S-8W; "	791	1680	294	18	150	98	65	320	130	41	N.P.		

Well name	Location	depth to Megargel, feet below sea level	Interval 2: interval thickness (ft)	Interval 2: total sand (ft)	Interval 2: sand percentage	Interval 2A: interval thickness (ft)	Interval 2A: total sand (ft)	Interval 2A: sand percentage	Interval 1: interval thickness (ft)	Interval 1: total sand (ft)	Interval 1: sand percentage	Interval 1A: interval thickness (ft)	Interval 1A: total sand (ft)	Interval 1A: sand percentage
P. Browning; Miller #1	NW NW SW 29-4S-8W; Jefferson Co., OK	783	1763	516	29	183	110	60	N.PEN.			N.PEN.		
H. Zweifel; Wright #1	SE SE SW 34-4S-8W; "	683	1600	[illegible]	25	N.P.			N.PEN.			N.P.		
Fidelity Royalty Co. et al.; Gover #1	C NW SW 3-4S-9W; "	1105	2145	601	28	N.P.			375	230	61	204	36	18
Nat'l Assoc. Petro.; Cooper #1	NW SE 4-4S-9W; Cotton Co., OK	1072	2072	518	25	172	58	34	N.PEN.			196	106	54
Continental Oil; Strat Test AA-109	SE SE SE 5-4S-9W; "	1049	2030	589	29	170	35	21	370	235	64	N.P.		
Continental Oil; Strat Test AA-107	SE SE NW 12-4S-9W; Jefferson Co., OK	1039	2034	491	24	N.P.			461	148	32	176	48	27
M. T. McLaughlin; Cofer #1	SW SE SW 26-4S-9W; "	508	1560	328	21	150	75	50	240	37	15	141	17	12
F. Govin; Foster #1	C NW SE 27-4S-9W; "	663	1621	308	19	161	74	46	309	104	34	187	66	35
Fidelity Royalty et al.; Eckler #1	NW NW SE 29-4S-9W; Cotton Co., OK	565	1542	293	19	170	48	28	390	90	23	165	90	55
G. Grimes; Thompson #1	SW SW NE 31-4S-9W; "	414	1350	346	26	150	68	45	435	75	17	150	45	30
Pitts & Banner; Hight #1	SW SW SE 32-4S-9W; "	447	1339	268	20	169	83	49	241	49	20	183	39	21
Govin & Beard Oil; Fitzgerald #1	SE SE SW 35-4S-9W; Jefferson Co., OK	570	1442	317	22	173	107	62	358	66	18	167	43	26
Wilcox Oil et al.; Curry #1	SE SE NW 36-4S-9W; "	598	1512	247	16	157	90	57	N.PEN.			165	52	32
Brookwood Oil; Campell #1	SW SE SE 4-4S-10W; Cotton Co., OK	888	1870	505	27	165	86	52	N.PEN.			152	46	30
Cache Creek, Inc.; Blair-Guerry #1	SW SE 6-4S-10W; "	850	1720	464	27	150	65	43	N.PEN.			153	59	38
Bridwell Oil; Crow #1	NW NW NE 7-4S-10W; "	780	1703	294	17	183	40	22	677	149	22	159	46	29
Webb & Hunter; E. Bone #1	NW NW SW 9-4S-10W; "	769	1765	457	26	160	72	45	838	147	18	146	15	10
Snoddy Bros.; Staley #1	SW SW 12-4S-10W; "	792	1752	491	28	144	68	47	N.PEN.			146	48	33
Howell Co.; Yantis #1	SW SW SW 15-4S-10W; "	658	1642	460	28	157	34	22	N.PEN.			146	47	32
Blair Co.; School Land #1	NW NW SE 16-4S-10W; "	652	1653	424	26	158	48	30	N.PEN.			137	21	15
Foree Co.; Jones #1	SE SW SW 17-4S-10W; "	722	1678	430	26	148	50	34	N.PEN.			162	15	9
Christie-Stewart; Monroe #1	SE SE NW 22-4S-10W; "	650	1622	422	26	158	67	42	383	113	30	158	37	24

Well name	Location	depth to Megargel, feet below sea level	Interval 2 interval thickness (ft)	Interval 2 total sand (ft)	Interval 2 sand percentage	Interval 2A interval thickness (ft)	Interval 2A total sand (ft)	Interval 2A sand percentage	Interval 1 interval thickness (ft)	Interval 1 total sand (ft)	Interval 1 sand percentage	Interval 1A interval thickness (ft)	Interval 1A total sand (ft)	Interval 1A sand percentage
Featherston Oil; Waller #1	SE SE NE 23-4S-10W; Cotton Co., OK	614	1556	252	16	141	73	52	N.PEN.			137	18	13
C. R. Caudill; Jones #1	NW NW SE 24-4S-10W; "	600	1517	445	29	167	96	57	N.PEN.			153	20	13
Cochran & Cain; Thracher #1	NE SE NE 26-4S-10W; "	737	1400	308	22	155	114	74	N.PEN.			155	48	31
E. Griffin; Keeter #1	SW SW NE 27-4S-10W; "	784	1755	509	29	186	89	48	N.PEN.			N.PEN.		
Smiley-Norwood; Worsham #1	NW NW NE 28-4S-10W; "	849	1834	500	27	159	66	42	N.PEN.			153	25	16
Farris Oil; School Land #1	NW NW SW 29-4S-10W; "	986	1930	386	20	177	97	55	N.PEN.			N.PEN.		
Kewanee Oil; Wook-tah-nah #12	E½ NE SW 1-4S-11W; "	787	1734	380	22	156	31	20	620	192	31	158	10	6
Farris Co.; Ah-too-was-so-anne #1	SE SW NE 2-4S-11W; "	832	1790	608	34	163	47	29	670	145	21	165	26	16
McCasland Co.; Bertie #14	SW SW SE 2-4S-11W; "	819	1767	442	25	156	19	12	N.PEN.			166	32	19
Stanolind Oil; Yackeschi #1	NE NE NE 4-4S-11W; "	955	1934	406	21	149	43	29	N.PEN.			N.PEN.		
Norman & Graham; Graham #1	NW NW SW 5-4S-11W; "	1268	2239	605	27	142	95	67	N.PEN.			192	111	58
Farris et al.; Pue-Tay #1	SE SW NE 11-4S-11W; "	811	1765	335	19	149	36	24	N.PEN.			163	50	31
Kewanee Oil; Hi-ne-ni-yah #1	SW SW NW 11-4S-11W; "	965	1915	373	19	160	4	26	N.PEN.			N.PEN.		
Loffland; Coos-cho-nah #1	SE SE NW 12-4S-11W; "	820	1729	256	15	149	52	35	N.PEN.			N.PEN.		
Snoddy Bros.; Staley #1	NW SW SW 12-4S-11W; "	820	1765	494	28	147	37	25	N.PEN.			164	43	26
Kewanee Oil; Nau-ni #1	NW NW NE 14-4S-11W; "	1100	2012	382	19	174	37	21	N.PEN.			198	62	31
Choate Co.; Benson #1	SW NE SW 22-4S-11W; "	1132	2107	367	17	185	61	33	N.PEN.			193	15	7
Webb & Black; Dalleier #1	NE SE SW 23-4S-11W; "	1114	2035	407	20	183	84	46	N.PEN.			N.PEN.		
A. Beck; Stumbling Bear #1	NW NW NW 23-4S-11W; "	1162	2074	539	26	186	68	37	N.PEN.			N.PEN.		
Beck et al.; Henderson #1	SW SW NW 25-4S-11W; "	1006	1915	536	28	173	88	51	N.PEN.			179	10	6
W. Atkinson; Nowlin #1	SE SW SE 26-4S-11W; "	958	1900	589	31	181	113	62	N.PEN.			174	35	20
Sam Blassy; McKluskey #1	NE SE SE 32-4S-11W; "	959	1922	346	18	174	75	43	N.PEN.			N.PEN.		

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McCormic et al.; Rainwater #1	NW NW SE 35-4S-11W; Cotton Co., OK	965	1924	404	21	177	70	39	N.PEN.			157		66
G. Grimes; Benson #1	NE SE NE 36-4S-11W; "	908	1805	541	30	157	96	61	N.PEN			N.PEN.		
Bridwell Oil; Settlemires #1	SW SW NE 5-5S-8W; Jefferson Co., OK	475	1429	305	21	N.P.			471	212	45	171	68	40
C. Stewart; Guthrie #1	NE SW SW 6-5S-8W; "	555	1440	291	20	175	95	54	270	208	77	175	64	37
R. F. Campbell; Wright #1	SW SW NW 7-5S-8W; "	502	1428	365	25	176	80	45	N.PEN.			151	59	39
Seaboard Oil; Fisher #1	NW NW NE 9-5S-8W; "	661	1609	286	18	190	44	23	471	148	31	N.P.		
Elmo Betty; Echols #1	NW NW NW 11-5S-8W; "	596	1492	370	25	N.P.			451	106	24	N.P.		
Cache Creek Drig. Co.; Aulman #1	SE SE SE 12-5S-8W; "	538	1405	261	19	180	15	8	330	95	29	N.P.		
Woods Expl. Co.; Crews #1	NW SE NE 15-5S-8W; "	509	1451	360	25	N.P.			349	95	25	N.P.		
Daube Co.; Miller #1	SW SW NE 17-5S-8W; "	469	1440	296	21	N.P.			435	68	16	N.P.		
P. Hamner Drig.; Rainwater #1	SW SE NW 21-5S-8W; "	467	1441	430	30	151	61	40	310	96	31	199	51	25
Clowe & Compadre Oil; Schaffner #1	NE SW SW 26-5S-8W; "	553	1496	282	19	N.P.			334	85	25	184	24	13
Texoma Prod.; King #1	NW SW 30-5S-8W; "	427	1360	395	29	N.P.			330	92	28	180	28	16
W. H. Bryant; Doss #1	NE NE SE 33-5S-8W; "	508	1505	412	27	N.P.			430	116	27	N.P.		
J. C. Jennings; Ellis #1	SE SE NE 34-5S-8W; "	544	1484	307	21	N.P.			496	63	13	N.P.		
Clone & Compadre Oil; Baker #1	NE NE NE 35-5S-8W; "	569	1505	251	17	N.P.			403	124	31	N.P.		
Farris Oil; Hooper #1	NW NW SE 5-5S-9W; Cotton Co., OK	322	1255	552	43	N.P.			N.P.			N.P.		
R. F. Campbell; State #1	SE SE NE 13-5S-9W; Jefferson Co., OK	421	1405	281	20	145	46	32	445	95	21	N.P.		
O. M. Pierce; Kennedy #1	SE SW SW 25-5S-9W; "	431	1290	325	25	N.P.			410	160	39	N.P.		
Cities; Gardner #1	SE SE NE 36-5S-9W; "	417	1310	292	22	180	46	26	380	176	46	N.P.		
J. W. Hastings; Cliff #1	SE SW SE 1-5S-10W; Cotton Co., OK	862	1743	418	24	166	64	39	N.PEN.			162	49	30
E. P. Griffin; Malcon #1	SE SE NE 2-5S-10W; "	888	1819	455	25	159	90	57	N.PEN.			N.PEN.		

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Burke Royalty Co.; Warren #1	SW SW NW 3-5S-10W; Cotton Co., OK	837	1790	233	13	N.P			N.PEN.			N.PEN.		
Blair Co.; Purkey #1	SE SE NW 5-5S-10W; "	851	1730	190	11	175	64	37	N.PEN.			166	48	29
Bridwell Oil; Dyke #1	SW NE SW 6-5S-10W; "	851	1749	385	22	171	52	30	561	38	7	151	10	7
Bridwell Oil; Seward #1	SE NW NE 8-5S-10W; "	767	1655	232	14	163	77	47	N.PEN.			175	26	15
J. B. Russell; Dowling #1	NE NW NW 11-5S-10W; "	825	1855	482	26	167	88	53	N.PEN.			N.PEN.		
Griffin & Barbee; Suddith #1	NW NW NW 1-5S-11W; "	915	1910	439	23	174	76	44	N.PEN.			167	58	35
Glenn Grimes; Estep #1	NW NW NE 12-5S-11W; "	820	1810	290	16	168	53	32	N.PEN.			161	80	50
R. Maguire; Hargis #1	SE SE SE 4-6S-8W; Jefferson Co., OK	545	1505	226	15	N.P			495	156	32	N.P.		
Mack Oil; McMenamy #1	NW NW SE 7-6S-8W; "	924	1820	291	16	180	56	31	380	71	19	190	33	17
Mack Oil; Harris #1	NW NW SE 8-6S-8W; "	854	1812	363	20	167	26	16	428	96	22	178	34	19
Cayman Corp.; Rice #1	NE SW SW 9-6S-8W; "	583	1560	327	21	N.P			390	115	29	170	25	15
W. H. Hammon; Johnson #1	NW NW SE 9-6S-8W; "	448	1401	282	20	N.P			474	93	20	N.P.		
Hoard & Spradling; Perkins #1	NE NE SW 11-6S-8W; "	527	1485	201	14	N.P			385	116	30	N.P.		
Farris Oil; Holland #1	NE NE SW 15-6S-8W; "	677	1608	373	23	170	50	29	N.PEN.			190	67	35
Tenneco Oil; Brewer #1	C SE NW 16-6S-8W; "	747	N.P.			165	9	5	465	168	36	192	67	35
	The following wells are located in Clay Co., Texas:													
Abercrombie & Cullen; Jones #1	MEP & P Sur., Sec. 21, A-346	677	1631	326	20	148	60	41	499	50	11	156	24	15
Daube Co.; Langford #1	R. R. Brown Sur., A-14	443	1300	281	22	188	43	23	250	57	23	150	38	25
Davenport Co.; Landrum #1	Parker Co. School Land, Blk. 5	273	1252	175	14	162	18	11	398	157	39	N.P.		
Felderhoff Bros.; Parker #1	Lassiter Sur., Blk. 128, A-288	599	1495	269	18	N.P			595	87	15	148	63	43

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	The following wells are located in Clay Co., Texas:													
J. G. Fowler; Taylor #1	Mitchell Sur., A-327	792	1700	294	17	160	32	20	560	106	19	170	12	7
Frerck et al.; Larson #1	MW & E TP RR Sur., A-350, Sec. 7	315	1307	196	15	160	31	19	583	104	18	N.P.		
A. Goldsmith; Mrs. Lyon #1	Byer Bros. Subdiv., NW$\frac{1}{4}$ Blk. 17	136	1111	222	20	126	43	34	414	166	40	179	36	20
A. Goldsmith; Mrs. Lyon #1	Byer Bros. Subdiv., SE$\frac{1}{4}$ Blk. 50	322	1310	380	29	140	36	26	300	86	29	143	14	10
C. Y. Gorman; Taylor #17	Bacon Subdiv., SW$\frac{1}{4}$ Blk. 39	283	1245	254	20	165	41	25	585	118	20	145	12	8
G. R. Drlg.; Warne Heirs #1	BBB & C Sur. #2, A-760	723	1630	359	22	184	40	22	N.PEN.			183	22	12
Hull Oil; Harding #1	Lassiter Sur., A-289	684	1580	332	21	N.P.			N.PEN.			155	86	55
Hunt Oil; Langford #1	R. R. Brown Sur., A-14, Lot 7	482	1359	245	18	183	52	28	261	81	31	N.P.		
Kadane et al., Rigsby #1	Spetth & McCutchon, Sec. 18	633	1750	420	24	165	46	28	600	72	12	180	15	8
Luce-Guffy & Sligar; Moser #1	MEP & P RR Sur., Blk. 20, A-345	669	1550	326	21	N.P			470	172	37	150	21	14
Madden & Goldsmith; Rep. Nat'l Gas #1	Parker Co. School Land, A-374	112	1102	298	27	152	46	30	373	68	18	119	10	8
W. H. Metzner; Thornberry #51	Thornberry Subdiv., S$\frac{1}{2}$ Blk. 8	274	1195	300	25	N.P			501	47	9	178	3	2
Morris et al.; Parker #1	MEP & P RR Sur., Sec. 22, A-347	588	1540	370	24	N.P			350	30	9	155	13	8
J. P. Owen; Adams #1	Byer Bros. Subdiv., Blk. 148	811	1570	377	24	152	72	47	610	61	10	128	11	9
Palmer Drlg.; Garner #1	Byer Bros. Subdiv., Blk. 78	492	1439	201	14	144	53	37	481	81	17	171	5	3
Perkins & Cullum; Taylor 'Deep' #1	Bacon Subdiv., SE$\frac{1}{4}$ Blk. 44	235	1203	247	21	N.P			607	144	24	157	18	11
Shaw Oil; Boddy #1	Bacon Subdiv., Blk. 51	375	1340	241	18	147	12	8	620	136	22	155	22	14
Texas Co.; Dowdy #1	BBB & C Sur., NW$\frac{1}{4}$ Sec. 15	722	1679	302	18	162	49	30	561	103	18	171	18	11
Texas Co.; O. B. Leath #1	BBB & C Sur., Sec. 13, A-65	751	1752	403	23	163	43	26	708	207	29	185	42	23

Well name	Location	depth to Megargel, feet below sea level	Interval 2			Interval 2A			Interval 1			Interval 1A		
			interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage	interval thickness (ft)	total sand (ft)	sand percentage
	The following wells are located in Clay Co., Texas:													
L. M. White; Wolf #1	Spetth & McCutcheon, S½ Blk. 3	821	1791	269	15	160	40	25	579	135	23	186	21	11
F. Wood; Dunn #2	Eyer Bros. Subdiv., Blk. 84	447	1350	365	27	142	38	27	590	95	16	173	36	21
F. Wood; Dunn 'B'	Belcher 102, Blk. 1	513	1408	352	25	149	16	11	492	54	11	117	5	4

VITA

KENT ALAN BOWKER

Candidate for the Degree of

Master of Science

Thesis: STRATIGRAPHY, SEDIMENTOLOGY, AND URANIUM POTENTIAL OF VIRGILIAN THROUGH LEONARDIAN STRATA IN WESTERN MARIETTA BASIN AND CENTRAL MUENSTER-WAURIKA ARCH, OKLAHOMA AND TEXAS

Major Field: Geology

Biographical:

Personal Data: Born in Dearborn, Michigan, April 4, 1956; the son of Mrs. Jo Anne Bowker.

Education: Received Bachelor of Science degree in Earth Science from Adrian College, Michigan, in May, 1978; completed requirements for Master of Science degree at Oklahoma State University in December, 1980, with a major in Geology.

Professional Experience: Junior member of the American Association of Petroleum Geologists, 1978; Teaching Assistant, Department of Geology, Oklahoma State University, 1978-1980; Consultant, MAPCO Inc., southeast Alaska, 1979.