STRUCTURAL STUDY OF THE HUNTON LIME OF THE WILZETTA FIELD, T12-13N, R5E, LINCOLN COUNTY, OKLAHOMA, PERTAINING TO THE EXPLORATION FOR HYDROCARBONS

By

HELEN SUE KINCAID WAY

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1968

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
July, 1983

STRUCTURAL STUDY OF THE HUNTON LIME OF THE
WILZETTA FIELD, T12-13N, R5E, LINCOLN
COUNTY, OKLAHOMA, PERTAINING TO THE
EXPLORATION FOR HYDROCARBONS

Thesis Approved:

John D. Naff
Thesis Adviser

Zuhair al-Shaieb

Novell Donovan

Norman N. Durham
Dean of the Graduate College

PREFACE

This study deals with the Hunton Group of the Wilzetta Field in Lincoln County, Oklahoma. The depositional environment was inferred from studying the outcrop areas in southern and northeastern Oklahoma. Geologic history was based on studies of electric logs, core and sample descriptions, seismic data, correlation cross sections, structure contour maps, and an isopach interval thickness map.

The writer extends her sincere gratitude to Dr. John D. Naff, thesis adviser, for guidance and encouragement throughout the study. I am also endebted to my advisory committee members for their patience and to Gene Southwick, Vector Energy Corporation for making available any information necessary. Ray Smith, president of Mustang Production Company, allowed the use to Mustang's facilities in further work on the thesis.

I thank my husband Gary, and my children, Tim and Chris, for allowing me time away from them to work on the research and drafting of the thesis.

Finally the writer gives special thanks to my father, J. O. Fair, who passed away before this thesis was completed, and my mother, Helen Fair, for their sacrifices and encouragement to further my education.

TABLE OF CONTENTS

TABLE

LIST OF FIGURES

LIST OF PLATES

CHAPTER I

ABSTRACT

The "Hunton" of the Hunton Group in the Wilzetta Field of Oklahoma is equivalent to the surface Clarita Formation of the Chimneyhill Subgroup. The "Hunton" in the Wilzetta Field averages 70' in thickness and is a dolomitic limestone.

The "Hunton" has been subjected to much post-depositional alteration. It was dolomitized shortly after deposition, opening up vugs and fractures, dissolving fossils, and recrystallizing the limestone. During the Middle and Upper Pennsylvanian the area was subjected to faulting, related to activity along the Nemaha Ridge and Ozark Uplift. A major fault zone, locally extending SW to NE, developed a ridge with displacements up to 400'. The ridge is cut by en echlon transverse faults. Fracture planes along the faults also show evidence of dolomitization. The processes of faulting and dolomitization combine to improve reservior conditions. Favorable areas for exploration for hydrocarbons would be defined by the fault block structures.

The Wilzetta Field has been in production for over 55 years and still appears to have many undrilled pockets created by the en echlon transverse faults.

CHAPTER II

INTRODUCTION

The stratigraphic section for this study is referred to as the Chimneyhill Subgroup, Hunton Group, Silurian (Jordan, 1957). The area of investigation is T12, 13N-R5E in Lincoln County, Oklahoma (Figure 1).

The Chimneyhill is the name used at the type locality in the Arbuckle Mountain region. It is composed of 3 formations: Keel-Ideal Quarry Member, Cochrane Member, and Clarita Member (Amsden, 1960). The subsurface in the northeastern quarter of Oklahoma is of slightly different lithology and terminology. The "Hunton" in Lincoln County is represented by the Clarita Formation of the Chimneyhill Subgroup (Amsden, 1975). A type log of the Lincoln County "Hunton" is shown in Figure 2. The "Hunton" in the Wilzetta Field dips to the south. It has been affected by post depositional dolomitization. Some of the dolomite was formed after faulting. Fracture planes along the fault lines, as shown in core samples, have been affected by the dolomite formation and enhanced porosity and permeability can be identified. The structure of the "Hunton" has been affected by normal faults and en echlon transverse faults. Oil traps are structural (Fair, 1975). To the north there is evidence of a later period of refaulting. The main fault zone is part of a larger regional structure extending 130+ miles to the north from the south.

Although there have been drilled a large number of shallow zone wells, the axis of faulting in these shallow zones is shifted to the southeast due to influences of the Ozark Uplift. The amount of displacement along the major faults in the shallow zones is less than found in the deeper zones. The en echelon faulting is less evident in these shallow zones also. It is necessary to stu ɣ the deeper zones in detail since a false conclusion could be drawn if just the shallow zones are taken into consideration.

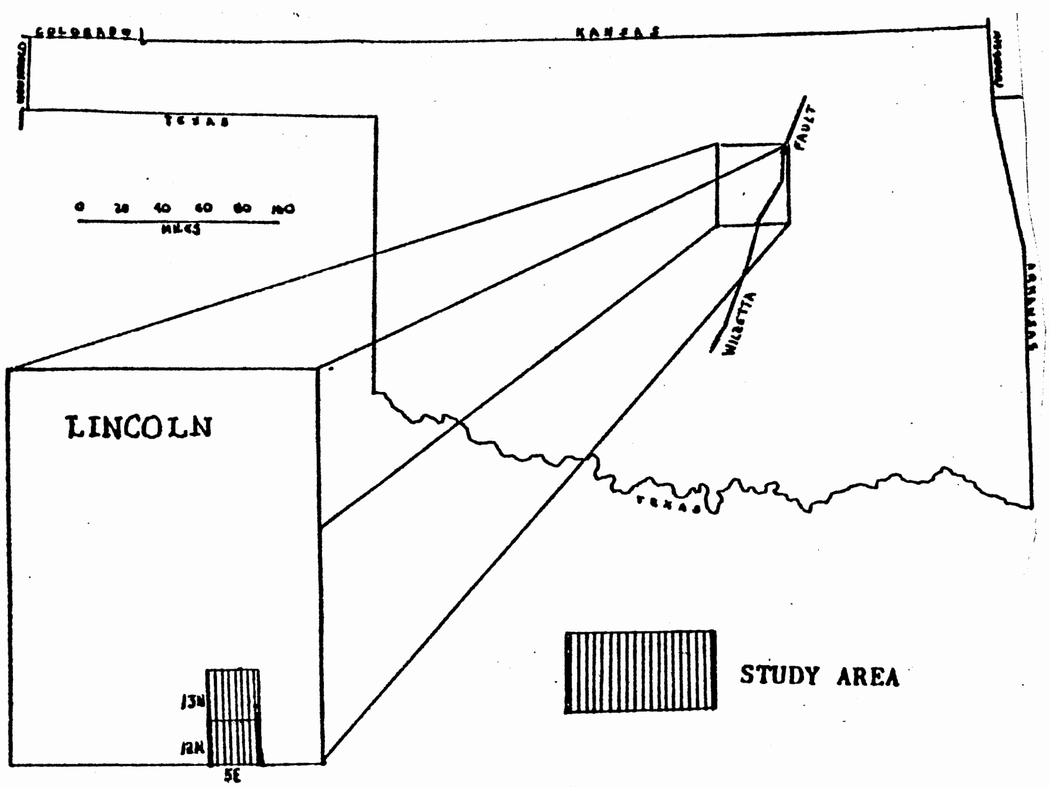

Fig. 1 Location map

Bunker Exploration McElvaney #1 SWNW Sec. 10-T12N-R5E

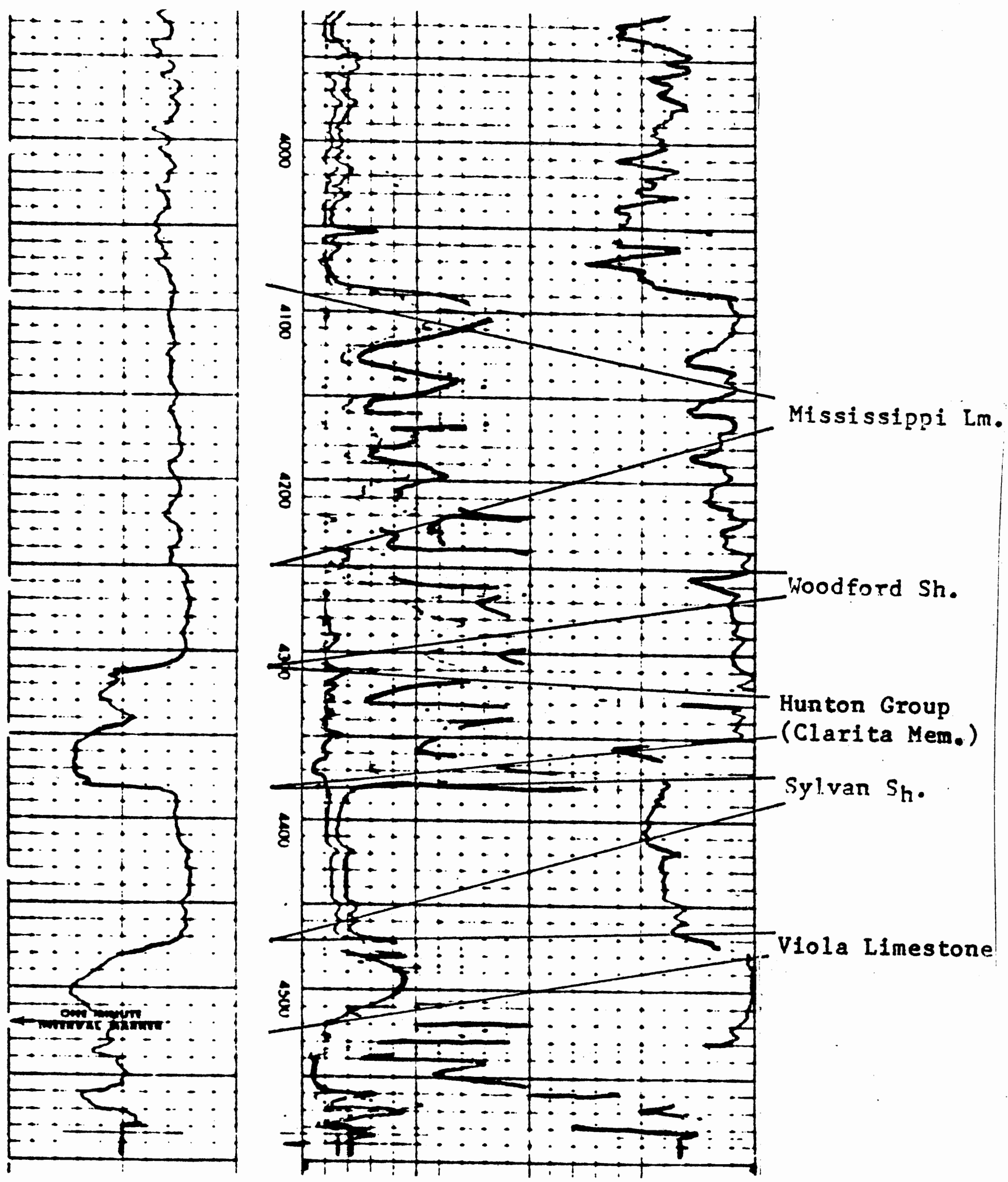

Fig. 2 Type Log

Objectives and Procedures

The objectives of this subsurface study are to explore the post depositional environment and structural development of the "Hunton" within the Wilzetta Field area.

The principle data for this study are electric logs, a core analysis, and sample studies. All are from wells in the study area (Figure 3). Oil and gas fields in the area are also found in Figure 3. The structural development is based on 6 structural cross-sections (Plates 1-6) and one seismic line (Plate 7). The locations of these are shown on Figure 4.

The structural configuations of the "Hunton" is shown on 3 (Plates 8-10) structural contour maps. These maps are; top of the Prue Sand, top of the "Hunton" unconformity, top of the Viola Lime. There (Plate 11) is an interval isopach map of the Brown Lime to the Mississippi-Mayes interval. These maps help develop a relative time scale for the faulting of the "Hunton."

Previous Investigations

The first study of the "Hunton" was made by G. H. Girty in 1899 in a report on Paleozoic invertebrate fossils in the McAlester Coal Field, Indian Territory. The work was continued by Reeds (1911), (1926), Maxwell (1931, 1936), Cloud (1942), Amsden (1949 through 1980) and Boucot (1958). Shannon (1962) correlated the subsurface Silurian and Early Devonian throughout Oklahoma. Ham, Dott, Burwel and Oakes

(1943) studied the St. Claire limestone near Marble City in northeastern Oklahoma. Shannon (1962) studied the Hunton Group and related the strata in Oklahoma. None of these studies point out the structural complexities of the area. J. O. Fair and Gene Southwick began intensive subsurface studies and drilling in 1975. They subsequently discovered and mapped many of the faults on the Wilzetta area.

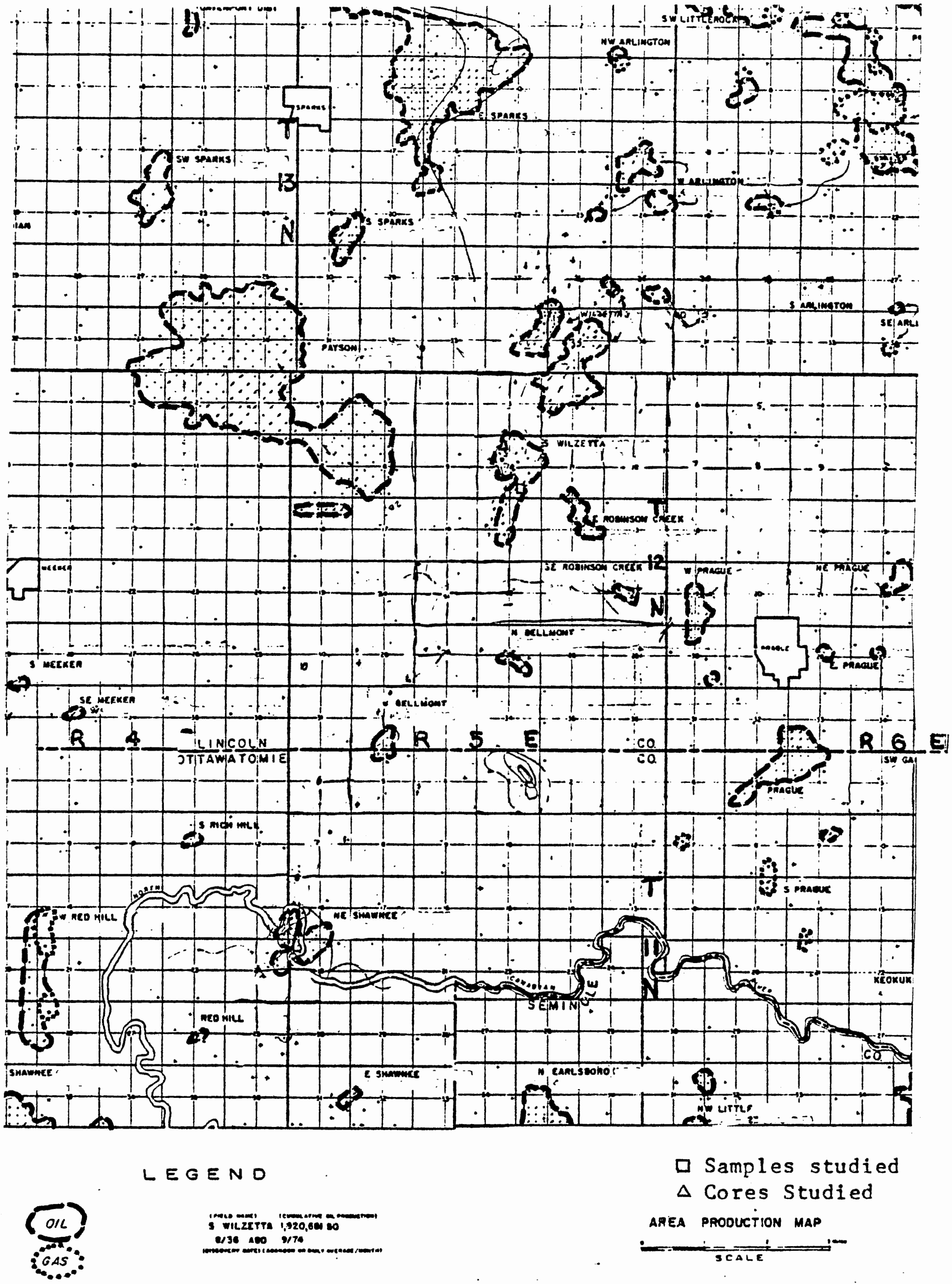

Fig. 3 Location map of wells, oil and gas fields, and cored and sampled wells

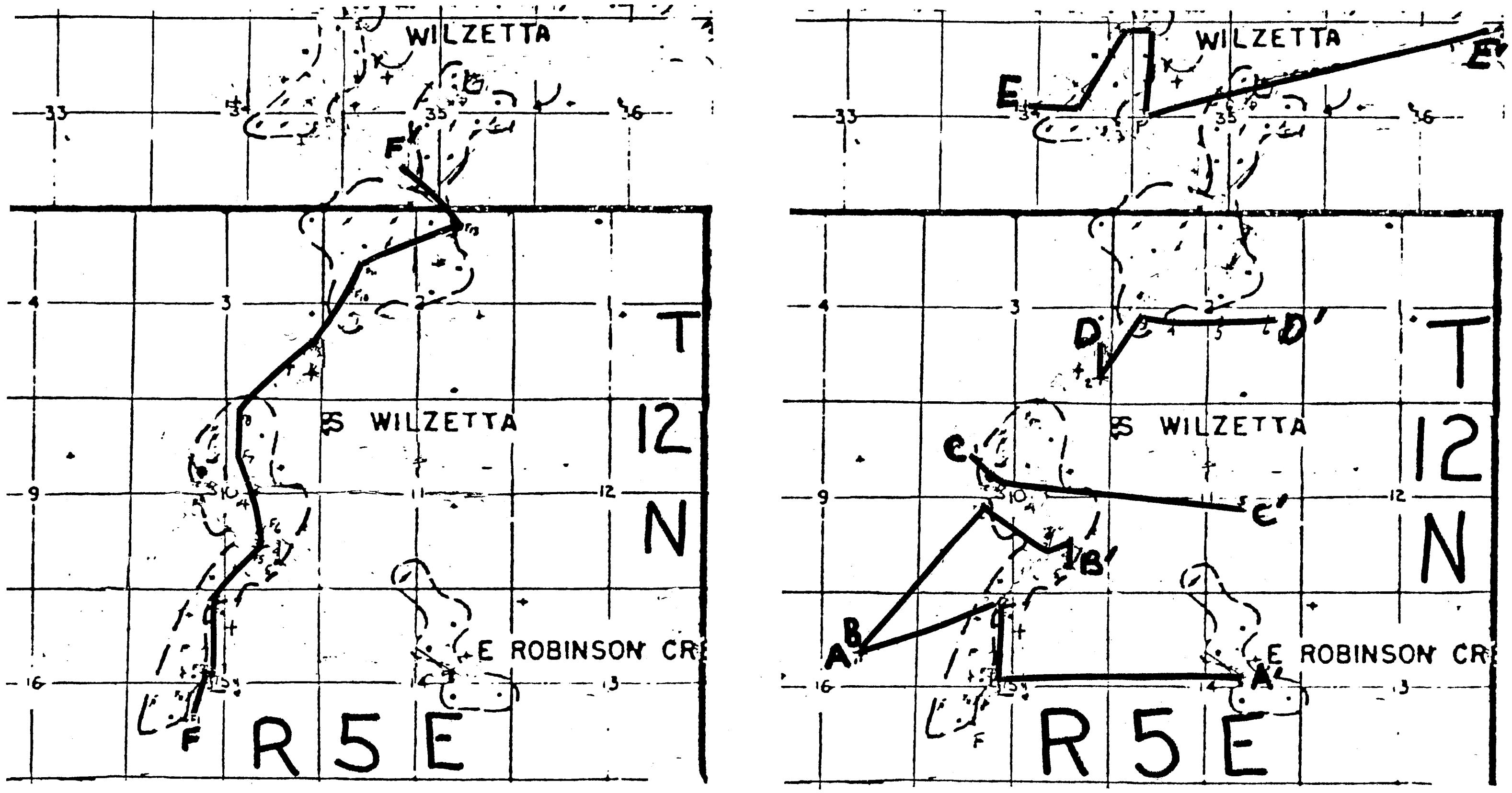

Fig. 4 Index Map of Structural Correlation Cross Sections

CHAPTER III

STRATIGRAPHIC FRAMEWORK

The "Hunton" in the Wilzetta Field is an average of 70' thick. It is a fossiliferous dolomitized limestone which thins to the north and northeast. The "Hunton" is absent entirely only a few miles north (Figure 5) due to post depositional erosion more than to events at the time of deposition. The "Hunton" becomes thicker to the south. More and more of the Hunton section is present and the entire section outcrops in the Arbuckle region of southern Oklahoma.

The "Hunton" of Wilzetta is the Chimney Hill Subgroup, Clarita Formation. The Clarita is easily identified in samples by its pink crinoid content. It is a detrital shelf deposit with evidence of minor wave and current action.

The Clarita Formation in Wilzetta is overlain unconformably by the Woodford Shale and isolated pockets of Misener Sand of Upper Devonian Age. The Clarita is unconformably underlain by the Sylvan Shale of Ordovician Age (Table I).

Maps

One isopach (Plate 12) map was constructed to show the effect of the faulting on the Upper Pennsylvanian strata.

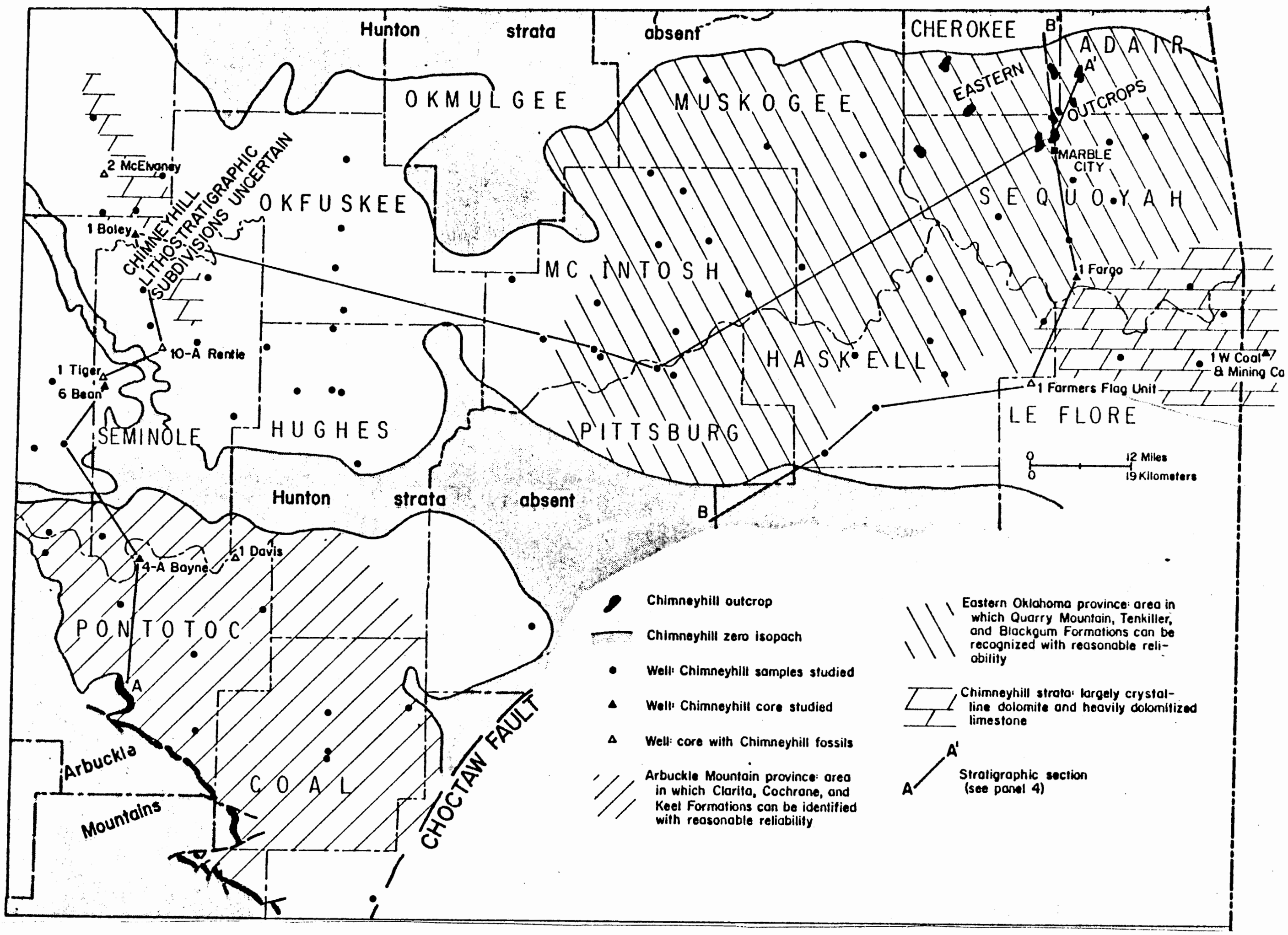

Fig. 5 Map showing distribution of the Chimneyhill Subgroup in eastern Oklahoma (Amsden, 1980)

TABLE I

EQUIVALENT SURFACE UNITS OF ROCKS IN THIS STUDY
(MODIFIED FROM AMSDEN, 1975, 1980)

SURFACE	SUBSURFACE
Upper Devonian	
Woodford Shale	Woodford Shale
Misener Sand	Misener Sand
Lower Devonian	
Frisco	
Haragan-B'D'Arc	
Upper Silurian	
Henryhouse	
Chimney Hill	Chimney Hill
Clarita	Clarita
Lower Silurian	
Chimney Hill	
Cochrane	
Ideal Quarry-Keel	
Upper Ordovician	
Sylvan Shale	Sylvan Shale

The Brown Lime-Mississippian Mayes interval isopach map shows a ridge between the 2 major SW-NE fault lines. The interval thickness varies from 150' to 250'. The major areas of hydrocarbon development correspond to the areas of thinner deposits indicating structural highs in the lower zones.

CHAPTER IV

STRUCTURAL FRAMEWORK

Regional Setting

The study area is within the central shelf area. It is bordered by the Ozark Uplift to the Northeast, and the Arkoma Basin-Ouachita Uplift to the south. Local dip is from northwest at a slight angle. (Figure 6) Stratigraphic facies changes are masked to some extent by secondary dolomitization. The main post-depositional activity has been faulting and dolomitization.

Local Structural Features

Plates 8, 9, and 10, show the extent of the local structrual featrues of the study area. The major feature, the Wilzetta Fault, trends southwest to northeast for approximately 130 miles. Locally this fault is not a single feature but appears to be ridge or horst structure with related en echlon transverse faulting. Displacement along the faults varies from less than 20' to more than 400' in the study area. The faulting is less evident in the Prue indicating less activity during the middle Pennsylvanian Des Moines time, the faulting relates to activity along the

Nemaha Ridge. Numerous structural traps have been created by faulting.

Seismic Studies

Old seismic work was done during the 1930's and 1940's and was made available to J. O. Fair and Bunker Exploration during a study of the area from 1974-1978. They are of poor quality and have been previously interpreted. Through them were established the main SW-NE fault lines. A new line run in 1977 adjoins the study area to the south. It clearly shows the E-W transverse faults between the major fault lines (Plate 7).

Maps

Three structural (Plates 8-10) maps were constructed to show the structural attitide of the "Hunton" and its relation to the beds above and below it and the thickness variations of the pre-Pennsylvanian strata.

Plates 8-10 depict local structural features within the study area. The major features are the SW-NE trending fault zones. Located east of the Nemaha Ridge, the faults run approximately 130 miles and have up to 400' of displacement (Fair-Southwick 1975). Locally the displacement ranges from 100 to 400 feet. Perpendicular to these faults are smaller E-W trending normal transverse faults with displacements from 20 to 100 feet. The faulting is much less pronounced in the shallower Middle Pennsylvanian Prue beds, indicating

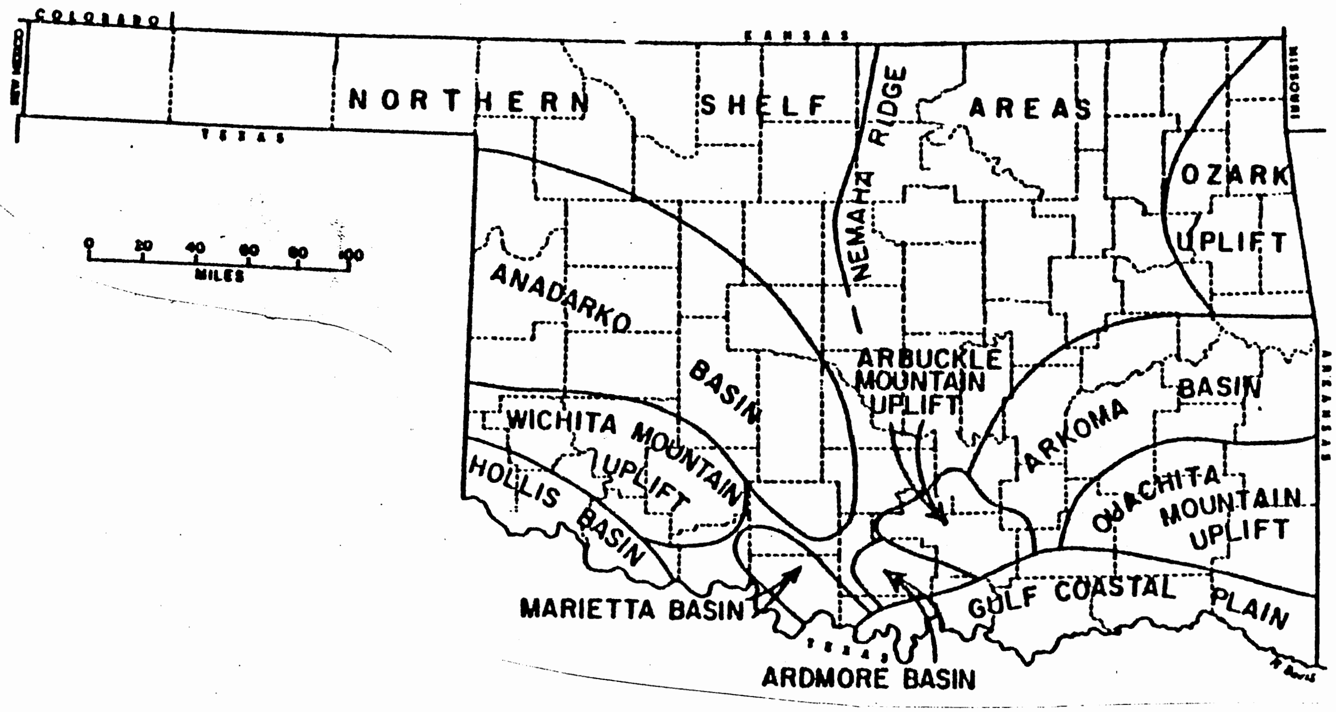

Fig. 6 Geologic province map. After Okla. Geol. Survey map, undated, Geologic Provinces of Oklahoma

that the faulting was beginning to die out by Middle Pennsylvanian time.

The Prue Structure Contour Map (Plate 8) has less closure and a lesser degree of displacement along the main SW-NE fault zones than is present at depth. The axis of the structure has shifted to the east approximately 1/4 mile. This is most likely due to structural growth during regional tilting of the area by the Ozark Uplift, especially in the northern half of Section 10-T12N-R5E. The reliance on shallow structure to reflect deeper structure obviously could lead to erroneous conclusions as to the location of deeper structure related production.

The Hunton Structure Contour Map (Plate 9) indicates a great amount of closure due to faulting. Where well control is adequate, the indication of displacement is from 350' in Section 10 to 70' in Section 15. These are normal faults with the apparent 90° transverse faulting. These transverse faults create an excellent block to the movement of hydrocarbons within the "Hunton." The major fault displacements become less in magnitude to the south. The subsequent development of petroleum exploration to the south has been to a lesser degree than is shown in Sections 10 and 15. The character of the faults changes to the north, indicating a possibility of a later period of refaulting further complicating the structrual development.

The Viola Structural Contour Map (Plate 10) exhibits the same fault patterns and structural closures. The axis of the ridge is located slightly NW of the "Hunton" axis. Production in the Viola limestone continues to be related to the ridge between the major fault lines allowing for the entrapment of the hydrocarbons due to faulting.

Correlation

To accurately correlate and better illustrate the structural relationships, six east-west and one north-south correlation cross-sections were constructed using - 3400' subsea as the datum. These structural correlation cross sections can be used to show the transverse faults perpendicular to the major fault zones. Locations of the correlation sections are shown on Figure 4.

Correlation Sections

East-West Structural Correlation Sections

Five east-west structural correlation cross sections (Plates 1-5) illustrate the faulting which created the ridge and structural closure for the entrapment of hydrocarbons in the study area. The interval from the Brown Lime to The Mississippian Mayes illustrates the lessening effect of this faulting on the upper beds.

Correlation Section A-A'. The thickness of the "Hunton" is uniform 60' to 75' (Plate 1). A large normal fault occurs between Wells 1 and 2 with 220' of displacement. The high of the structure is found in Well 3. The Julia Pantlik

#1 is the only well in the field which produces from the upper "Hunton" zone. The normal fault between Wells 3 and 4 shows the "Hunton" to be shifted opposite shales on both sides of the fault, restricting hydrocarbon movement.

Correlation Section B-B'. The "Hunton" in Well 1 is 545' lower than in Well 2 (Plate 2). Movement was along a normal fault. Well 2 shows evidence of a fault between the "Pink Lime" and the Inola Limestone cutting out about 75' of Red Fork Sand. The normal fault between Wells 4 and 5 shows 110' of displacement, again exhibiting the permeable "Hunton" moved opposite an impermeable shale layer.

Correlation Section C-C'. Well 1 (Plate 3) is cut by a normal fault through the Bartlesville sand and shortening it by 20', this is a stress fault. The "Hunton" is 30' lower in Well 1. Wells 5 and 6 are separated by a normal fault with a displacement of approximately 100'.

Correlation Section D-D'. A normal fault displacing 66' in the "Hunton" between Wells 3 and 4 (Plate 4) shows the "Hunton" brought against impermeable shales. Displacement at the "Brown Lime" is 40' and only 12' at the Prue Sand.

Correlation Section E-E'. The major SW-NE fault lines between Wells 1 and 2 (Plate 5) with the "Hunton" on the downthrown side 345' lower. A transverse fault lies between Wells 2 and 3 and 3 and 4. The "Hunton" in Well 3 is 128' lower than in Wells 2 and 4. Another major fault lies between Wells 7 and 8.

North-South Structural Correlation Cross Sections

The North-South correlation section trends between the major fault lines to better illustrate the East-West en echlon transverse faults.

Correlation Section F-F'. A transverse fault occurs between Wells 1 and 2 (Plate 6), Wells 5 and 6, and Wells 7 and 8. The major fault zones occur between Wells 3 and 4, Wells 11 and 12, and Wells 13 and 14, all of which are normal faults. The transverse faults between Wells 1 and 2 and Wells 5 and 6 are substantiated by a seismic line (Plate 7). Displacement along these stress faults varies from 16' to 28'. The major fault between Wells 13 and 14 does not appear to extend much beyond the SE/4 of Section 13-T13N-R5E, displacement here is less than to 20'.

CHAPTER V

DEPOSITIONAL FRAMEWORK

Petrology

Cores from 1 well and samples from 1 well were examined and described. Generalized core and sample descriptions are found in Appendix B.

Core Descriptions

Clarita Formation. The formation is dolomitic limestone. Pores are generally fossils which have been removed by solution leaving molds of crinoindal debris. The Clarita here corresponds with the Fitzhugh. The top 18" of marlstone could be remnants of the Henryhouse. The entire cored section has been exposed to intensive solution which developed many cracks. There were later filled with Misener Sand and veins of sandstone are present thoughout the cored section (Fair, Bunker, and Southwick, 1975).

Sample Descriptions

Rotary drill bit cuttings from the "Hunton" in one well were studied. A description of these in the Bunker Exploration Ladra #1 SE NW SW SE Section 10-T12N-R5E (Figure

Fine to med. grain tan dolo. and white dol. limestone, spotty stain & odor
Coarse dolo. with stain & odor

Green to gray shale, fiss.

Limestone-coarse grain with pink xls. Spotty stain on frags with sec. calcite

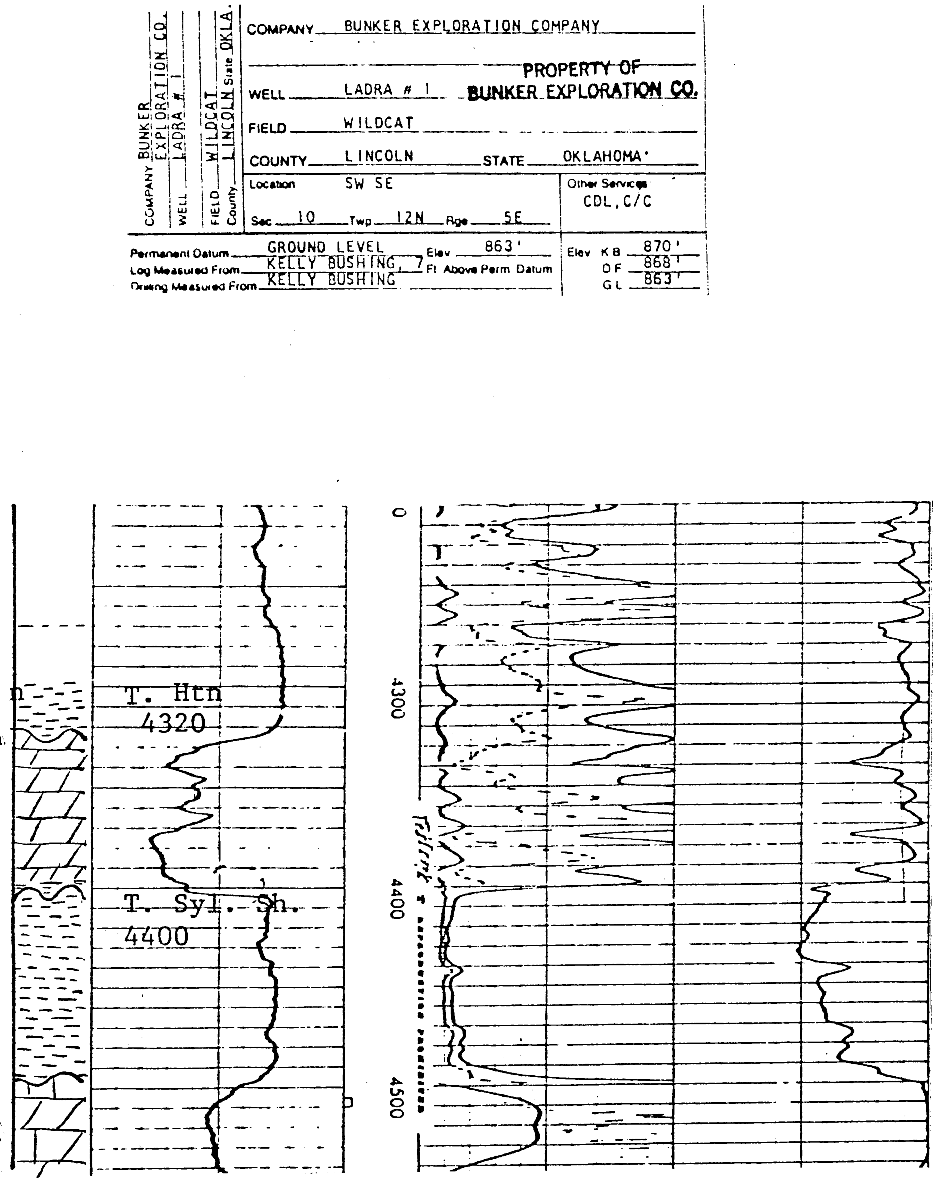

Fig. 7 Sample Log and Electric Log
Bunker Ladra #1

7) from the top down are: 45' fine to medium grain tan dolomitic limestone with white limestone (Could be sandstone with calcareous cement), 38' crystalline dolomite (Fair, Bunker and Southwick, 1975).

Depositional Environment

The Chimney Hill Subgroup of the Hunton Group is of the Niagaran and Alexandrian Series of the Silurian. It is overlain in the full section by the Henryhouse Subgroup and underlain by the Upper Ordovician Sylvan Formation (Amsden, 1960).

Lithofacies

Type Locality-Arbuckle Region. The Chimney Hill Subgroup has three members: Ideal Quarry-Keel Member, Cochrane Member, Clarita Member. All are detrial limestones, low in silt and clay and magnesium content.

Ideal Quarry Member. The Ideal Quarry Member is a fossiliferous calcerenite with some nodules of chert. It is 50% fossil material in thin section. The matrix is of clay- to silt-sized carbonate of brown or clear crystalline calcite. Many fossils are coated with thin concentric layers which could be algal öolites and pisolites. The insolubles are limonite and glauconite. Less than 2% of the member is $MgCO_3$. This Member grades into the Keel Member suggesting different environments of deposition, and probably a shallow water deposit.

Keel Member. The Keel Member is a light to medium gray öolitie limestone. In some areas there is distinct bedding between the öolites and pisolites, others show cross-bedding or indistinct bedding. There is some silicification in the öolites or in nodules of chert. Limonite and glauconite make up less than 1% of the Keel. The öolites have concentric structure, many with fossil cores. All fossils are coated with the same granular substance as the öolites. Two beds are denoted by matrix types, one is sparry calcite, the other granular like the öolites. One explanation for the presence of two matrices is current variations. The upper and lower beds are gray öolitic limestones, the middle bed is a thinly laminated calcalutite with no öolites. These beds were probably deposited in warm, calcium saturated waters. Variations in saturation levels determined the occurence of öolitic structure. These beds are very similar to deposition in the Bahama Banks today.

Cochrane Member. The Cochrane Member is a glauconitic bioclasitic limestone unconformably overlying the Keel Member. Chert occurs in irregular nodules and lenses. Detrital and secondary silicas are also present. The Cochrane is a high calcium limestone with a large fossil content typifying a warm water, offshore shelf deposit. The Cochrane is unconformably overlain by the Clarita Formation.

Clarita Formation. The Clarita is a fossiliferous bioclastic limestone, noted for the presence of pink

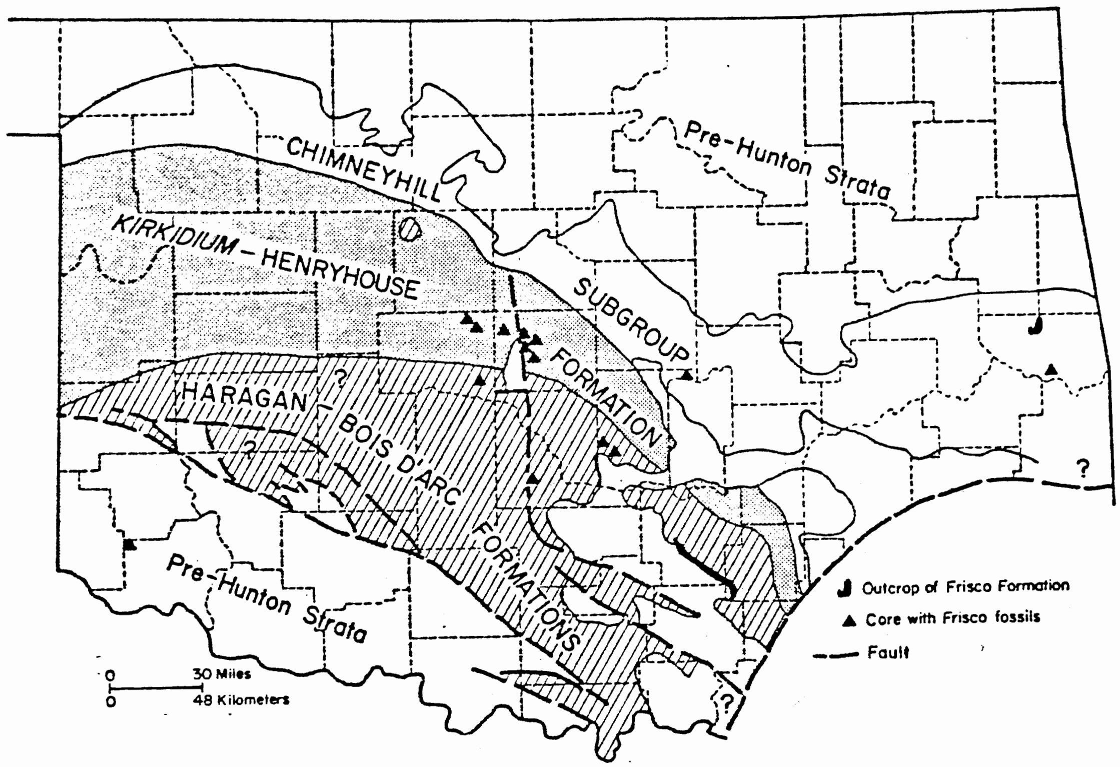

Fig. 8 Distribution of Pre-Middle Devonian Formations (Amsden, 1980)

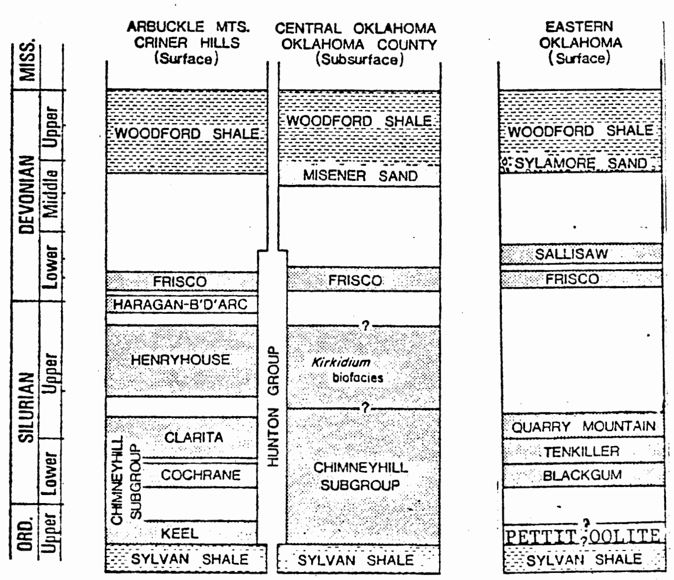

Fig. 9 Inferred relationship of Late Ordovician to Early Mississippian (Amsden, 1975, 1980)

crinoidal debris. The lower zone is an argillaceous marlstone that weathers as shale and has a high level of insolubles. The upper zone includes a silt-clay distribution. The level of insolubles in the upper zone is from 1% to 20%. The Clarita is a shelf deposit, close to a source of detrital material and subjected to a minimum of current action. The Henryhouse unconformably overlies the Clarita.

Northeastern Oklahoma-Arkansas Locality. In Northeastern Oklahoma and Arkansas the nomenclature changes to the St. Claire Group whose members are: Pettit öolite Formation, Blackgum Formation, Tenkiller Formation and the Quarry Mountain Formation (Figure 9). The Hunton Group gradually thins and is absent in a large portion of northern Oklahoma (Figure 8) (Amsden, 1980).

Southern Lincoln County Oklahoma. In southern Lincoln County the Hunton Group is represented only by the Chimney Hill which is unconformably overlain by the Misener Sand and the Woodford Shale. The Clarita Formation is the only part of the Chimney Hill represented. It has been highly dolomitized, although molds of the characteristic crinoidal debris are abundant.

Geologic History

The Chimney Hill is a marine shelf deposit as evidenced by the following: (1) evenly bedded characteristics; (2) clastic limestone of 50% fossils with minor fragmentation;

(3) detrital material is silt sized and less than 10% insolubles are present; (4) a large and varied fauna is represented. The introduction of dolomite was subsequent to deposition but evidently before the beds were buried very deeply (Amsden, 1980). The dolomite line as shown in Figure 10 divides the area of limestone, dolomitic limestone and dolomite.

The process of dolomitization first appears as scattered crystals in an organo-detrital limestone. The crystals grow and impinge on the fossils. Finally all organic material is replaced and crystalline dolomite occurs. The occurance of the dolomite zone is independent of structures and unconformities. The geographical scale is massive. Amsden postulates the dolomitization occurred soon after deposition from changes in the magnesium content in the seawater (Amsden, 1980). In Lincoln County the dolomitic process is about middle stage. The dolomite present here is a dolomitic limestone with zones of pure limestone.

Structurally the area was quite active unitl the late Pennsylvanian (Amsden, 1980). The major fault zones bisect Ordovician, Silurian, Devonian, Mississippian, Lower and Middle Pennsylvanian and begin to die out in upper Pennsylvanian beds. The absence of the upper Hunton formations is probably related to post depositional tectonic activity related to the Nemaha Ridge and Ozark Uplift.

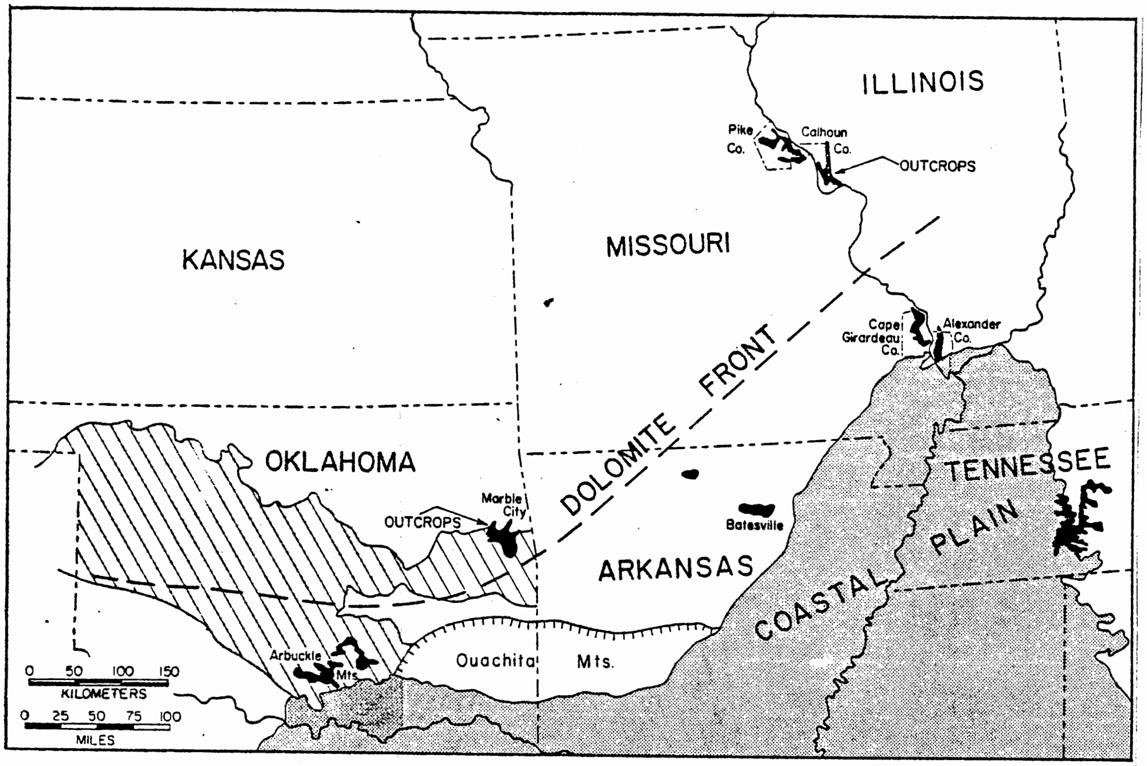

Fig. 10 Distribution of Late Ordovician-Silurian-Early Devonian outcrops in Central United States showing dolomite front (Amsden, 1975)

CHAPTER VI

PETROLEUM GEOLOGY

Production History

The first well drilled in the Wilzetta Field was in Section 35-T13N-R5E. The well was drilled in 1931 and abandoned prior to 1941 and produced from the Hunton zone. The Wilzetta was "rediscovered and redeveloped" in several productive zones in the 1930's through the 1970's, the latest well being drilled in 1981. The first well drilled due to extensive seismic data was the Pernika #1, Section 27-T12N-R5E, 1965.

The Hunton discovery well was drilled in 1936, Section 10. The Amarada Zimmerman #1 had an initial potential of 272 BO - 242 BWPD and recovered 56,000 BO. In 1943 it was plugged back to the Prue Sand Zone and produced.

Total Hunton Production in the Wilzetta Field is approximately 2.17 million barrels of oil (BO). Six wells are currently producing from the "Hunton." Total production from all producing zones in Wilzetta is 5.9 million BO (P.I., 1981) for the period from 1934 to 1981. Other productive zones in Wilzetta are: Prue Sand Zone, Red Fork Sand, Bartlesville Sand, Hunton, Viola, Dolomite, 1st and 2nd Wilcox.

Source Rocks

The hydrocarbon source of the "Hunton" is commonly attributed to the Woodford Shale. The Woodford is an organic-rich shale unconformably overlying the Hunton Group.

Porosity Development

The porosity of the "Hunton" in Wilzetta is a secondary development from the process of dolomitization and structural activity due to faulting. Recrystalization during dolomitization and solution of fossils opened vugs and pores to facilitate the passage of fluids. Faulting in the area resulted in fractures within the rock.

Exploration Significance

Exploration of the Wilzetta Field has disclosed its complex fault system. Many of these faults show less than 20' of displacement and serve to shift the "Hunton" opposite less permeable shale beds effectively trapping hydrocarbons. Only drilling can determine the location of these small faults therefore it is probable new pockets of "Hunton" production will be discovered within the field.

CHAPTER VII

SUMMARY AND CONCLUSION

The objectives of this thesis are to interpret the geologic history of the "Hunton" in the Wilzetta Field. This was accomplished by studying cores, well cuttings, electric logs and seismic data within the study area, and by mapping the structure of the "Hunton" and thickness of the post-Hunton beds.

1. The Lower Hunton was deposited on a shelf area in the Silurian and Middle Devonian. There were three periods of deposition in the Lower Hunton, Chimney Hill Subgroup separated by periods of erosion. The Lower Hunton is the only Subgroup represented in the Wilzetta Field.

2. The Upper Chinmey Hill, Clarita, the only member of the Subgroup present in the Wilzetta Field. The Misener sand infiltrates throughout the section indicating erosion after deposition.

3. The Clarita was dolomitized after deposition, before the strata was deeply buried and continuing on during the faulting processes. The dolomitization is part of a regional zone of dolomite replacement extending over a large geographic area.

4. During the late Pennsylvanian, the area was subjected to extensive faulting. A major SW-NE fault zone developed a ridge, extending approximately 130 miles. Locally displacement along these faults is up to 400'. Developed perpendicular to these are minor en echlon transverse faults with displacement of 60' or less. An extensive fracture system developed during the faulting along which dolomitization continued and enhanced and porosity and permeability of the "Hunton."

5. The Wilzetta Faults are excellent traps for hydrocarbons. Much exploration and development has been done since the discovery of the field in the 1930's. The "Hunton" of the Wilzetta Field has produced over 2.0 million barrels of oil, the other producing zones have a cumulative total of over 3.5 million barrels of oil. Most wells that are still producing in the field are classified as stripper oil and gas wells.

Future studies of the structure of the Wilzetta Field should include the area directly north. There is evidence of an area of either reverse faulting or overturned high angle normal faults.

REFERENCES CITED

Amsden, T. W., 1957, Stratigraphy of the Hunton Group: Okla. Geol. Survey, Circular 44, p. 5-26.

——— 1960, Hunton Stratigraphy: Okla. Geol. Survey, Bull. 84, p. 27-65.

——— 1965, Silurian Stratigraphy of Northeastern Oklahoma: Okla. Geol. Survey, Bull. 105, p. 7-67.

——— 1975, Hunton Group (Lower Ordovician, Silurian, and Early Devonian) in the Anadarko Basin of Oklahoma: Okla. Geol. Survey, Bull. 121, p. 9-23.

——— 1980, Hunton Group (Lower Ordovician, Silurian, and Early Devonian) in the Arkoma Basin of Oklahoma: Okla. Geol. Survey, Bull. 129, p. 14-41, 51-56.

Arbenz, J. K., 1956, Map of Tectonic Provinces of Oklahoma: Okla. Geol. Survey, Map GM-3.

Fair, Joseph O., 1975, Wilzetta Field Prospect Report, Unpub. report of J. O. Fair Consulting Services and Bunker Exploration.

Hollrah, Terry L., 1978, Sedimentary Cycles in the Virgilian Series (Upper Pennsylvania) of the Anadrako Basin: Shale Shaker, v. 28, p. 150-156, 168-175.

Isom, John W., 1973, Subsurface Stratigraphic Analysis, Late Ordovician to Early Mississippian, Oakdale-Campbell Trend, Woods, Major, and Woodward Counties, Oklahoma: Shale Shaker, v. 24, p. 115-132.

Oklahoma Geological Survey, 1978, Regional Geology of the Arbuckle Mountains Oklahoma: Okla. Geol. Survey.

Oklahoma Geological Survey, undated, Map of Geologic Provinces of Oklahoma: Okla. Geol. Survey.

Petroleum Information, 1982, Oklahoma Crude Production Report, Northeastern Oklahoma: Petroleum Information Corporation.

Southwick, Gene, 1975, Wilzetta Field Prospect Report, Bunker Exploration.

——— 1981, South Robinson Creek Prospect Report: Vector Energy Corporation.

——— 1982, Personal Interview, Vector Energy Corporation, December 15, 1982, Oklahoma City, Oklahoma.

APPENDIX A

NAMES AND LOCATIONS OF WELLS USED IN CORRELATION SECTIONS

No.	Operator and Well Number	Location
	East-West Correlation Section A-A'	
1.	Texaco, #1-A State	NE SW NE Sec. 16-12N-5E
2.	Jones & Shelburne, #2 Roller	NE NE NW Sec. 15-12N-5E
3.	Danciger Oil, #1 J. Pantlick	SE SE NW Sec. 15-12N-5E
4.	Bunker Expl., #1-15 Obsivac	SW SW NE Sec. 15-12N-5E
5.	Jones & Shelburne, #1-B Roller	SE SW SE Sec. 14-12N-5E
	East-West Correlation Section B-B'	
1.	Texaco, #1-X State	NE SW NE Sec. 16-12N-5E
2.	Davidor & Davidor, #1-B McElvaney	NW NE SW Sec. 10-12N-5E
3.	Jones & Shelburne, #2 Ladra	NE SW SE Sec. 10-12N-5E
4.	Jones & Shelburne, #1 Kozel	SW NE SE Sec. 10-12N-5E
5.	Jones & Shelburne, #1-B Kozel	NW SE SE Sec. 10-12N-5E
	East-West Correlation Section C-C'	
1.	Davidor & Davidor, #3 McElvaney	NW SE NW Sec. 10-12N-5E
2.	Bunker Expl., #1 McElvaney	C NW SW Sec. 10-12N-5E
3.	Davidor & Davidor, #1 McElvaney	SE SE NW Sec. 10-12N-5E
4.	Pace Petro., #1 Zimmerman	SW SW NE Sec. 10-12N-5E
5.	Parker Drlg., #1 Klabzuba Royalty	NW NE SE Sec. 11-12N-5E
	East-West Correlation Section D-D'	
1.	A. Ramsey, #1 Sedlacek	SE NE SE Sec. 3-12N-5E
2.	W. Lipski, #1 Frank Holik	SE NE SE Sec. 3-12N-5E
3.	Alma Oil, #1 Sedlacek	N/2 NW SW Sec. 2-12N-5E
4.	Gilespie & Sons, #1 Guild	NW NE SW Sec. 2-12N-5E
5.	H. Kramer, #1-A Hegar	NW NW SE Sec. 2-12N-5E
6.	Mohawk, #1 Meier	NW NE SE Sec. 2-12N-5E
	East-West Correlation Section E-E'	
1.	Phillips Petro., #1 Earl	SE SE NW Sec. 34-13N-5E
2.	Sam King, #4 Earlsbaugh	NE SW NE Sec. 34-13N-5E
3.	Phillips Petro., #7 Earlsbaugh	NE NE NE Sec. 34-13N-5E
4.	Danciger Oil, #3 Stasta	NW NW NW Sec. 35-13N-5E
5.	Four States Drlg., #1 Blasham	SW SW NE Sec. 35-13N-5E
6.	Davidor & Davidor, #2-A Jackson	NE SW NE Sec. 35-13N-5E
7.	Service Drlg., #1-36 State	NE NE NE Sec. 36-13N-5E

No.	Operator and Well Number	Location
	North-South Correlation Section F-F'	
1.	Amco Energy, #1 Youngblood	NW SE SW Sec. 15-12N-5E
2.	Amco Energy, #1 Pantlick	C NE SW Sec. 15-12N-5E
3.	Danciger Oil, #1 Julia Pantlick	SE SE NW Sec. 15-12N-5E
4.	Jones & Shelburne, #2 Roller	NE NE NW Sec. 15-12N-5E
5.	Jones & Shelburne, #2 Ladra	NE SW SE Sec. 10-12N-5E
6.	Pace Petro., #1 Zimmerman	SE SW NE Sec. 10-12N-5E
7.	Phillips Petro., #4 Zimmerman	NW SW NE Sec. 10-12N-5E
8.	M & M Drlg., #2 Zimmerman	NW NW NE Sec. 10-12N-5E
9.	A. Ramsey, #1 Sedlacek	SE NE SE Sec. 3-12N-5E
10.	C. L. McMahon Etal, #2 Rubac	CS/2 SW NE Sec. 3-12N-5E
11.	Allied Materials, #1 James	NE SW NW Sec. 2-12N-5E
12.	Four States Drlg., #1-A Bailey	NE NW NE Sec. 2-12N-5E
13.	Bishop Oil, #2 James	NW SE SW Sec. 35-13N-5E

APPENDIX B

GENERALIZED CORE AND SAMPLE DESCRIPTIONS

BUNKER EXPLORATION, #2 McELVANEY, C S/2 NE NW SEC. 10-12N-5E

LINCOLN COUNTY, OKLAHOMA

Condition of Core

Whole Core, sawed in half.

Field Report

Cored 4304 to 4329½: Recovered 23½ feet of core, 11' Woodford and 12½' Hunton, possibly 6" to 1' of Misener. Recovered 12' of Hunton with good vugular porosity, bleeding oil and gas.

Generalized Core Description

Woodford Shale
4250-4305'
Black Shale.
4305-3414'
Mostly dark shale with minor sandstone.
3414-4318'
Misener Sandstone. Calcareous quartz sandstone and organo-detrital limestone with scattered quartz grains; quartz grains usually rounded (many with overgrowths), up to 1mm in diameter. Misener conodonts.

Hunton Group
4318-4319'
Banded pale-gray and greenish-gray marlstone.
4319-4320'
Dolomitized organo-detrital crinoidal limestone; conodonts present, much evidence of solution and Misener Sandstone infiltration.
4320-4327'
Dolomitized organo-detrital limestone.
4327-4328'
Weakly dolomitized organo-detrital limestone; much solution and Misener Sandstone infiltration.
4328-4390'
Moderately to heavily dolomitized organo-detrital limestone and crystalline dolomite.

Sylvan Shale
4390-4490'

Special Studies

4317'
Misener-type conodonts, no Silurian conodonts.

Special Studies cont.

4318'
Marlstone, with similar lithology to underlying unit, assigned Clarita rather than Henryhouse.

4319'
Fitzhugh Member of the Clarita Formation represented here by the fauna P. bicornis.

The Misener-Hunton contact is located at 4317.5' and that the uppermost 18' marlstone bed, which could be Henryhouse, here is tentatively assigned to the Fitzhugh. The entire cored section has been exposed to intensive solution, which developed numerous cracks and crevices. These were later filled from above with Misener sand; clearly defined "veins" of sandstone are present through the cored section. The Misener is interesting because it includes beds of crinoidal limestone with only scattered quartz sand grains. The Chimneyhill is a dolomitic facies with all parts of the core showing at least some dolomitization. The strata from 4320' to 4323' are porous crystalline dolomite. The pores are largely fossils that have been removed by solution, leaving only molds (mostly crinoidal debris). Grain density is 2.8 for 4318-4427' and porosity ranges from less than 1.6% up to 24%. Chimneyhill strata in the #2 McElvaney is 57' thick if the upper marlstone bed is included.

BUNKER EXPLORATION, #1 LADRA, C SW SE SEC. 10-12N-5E

LINCOLN COUNTY, OKLAHOMA

Generalized Sample Description

Woodford Shale
4250'
Black shale with spores.

Hunton Lime
4324-4400'
4324-4370'
Fine to medium grain tan dolomite with white limestone, spotty stain and odor.
4370-4400'
Dolomite, coarse grain, stain and odor.

Sylvan Shale
4400-4490'
Green to gray shale, fiss.

VITA 2

Helen Sue Kinciad Way

Candidate for the Degree of

Master of Science

Thesis: STRUCTURAL STUDY OF THE HUNTON LIME OF THE WILZETTA FIELD, T12-13N, R5E, LINCOLN COUNTY, OKLAHOMA, PERTAINING TO THE EXPLORATION FOR HYDROCARBONS.

Major Field: Geology

Biographical:

Personal Data: Born Hayden, Colorado, July 28, 1945, the daughter of Mr. and Mrs. Joseph O. Fair; married to Gary H. Way, March 18, 1977; son Timothy born May 3, 1978, son Christopher born September 14, 1980.

Education: Graduated from Natrona County High School, Casper, Wyoming, May 1963; received Bachelor of Science degree in Geology from Oklahoma State University, Stillwater, Oklahoma, in May 1968; also received provisional teaching certificate in natural sciences from the State of Oklahoma in June 1968; completed an earth science education workshop sponsored by the National Science Foundation at Oklahoma State University in July 1972; completed the requirements for a Master of Science degree with a major in Geology at Oklahoma State University, in July 1983.

Professional Experience: Summer trainee Pan American Petroleum Corporation (Amoco), Casper, Wyoming 1964; Earth Sciences teacher, Stillwater Public Schools, September 1968 through May 1972; Geological Technician with LVO Corporation, Tulsa, Oklahoma, October 1973 through October 1974; Geologic Technician with Bunker Exploration, Oklahoma City, June 1975 through October 1977; Consulting Geologist from 1977 to 1981; Geological Technician with Mustang Production Company April 1982.