THE FORMULATION OF A DEVELOPMENT STRATEGY FOR A RODESSA GAS PLAY IN EASTERN DESOTO PARISH, LOUISIANA

Russell B. Hennessey[1] and Victoria Provenza[2]

ABSTRACT

A study of the Lower Cretaceous Bacon Limestone (First Rodessa Porosity) on the eastern edge of DeSoto Parish, northern Louisiana, involving thin-section study, and the correlation of conventional core analysis with resistivity log data, has led to the successful differentiation of two distinct sedimentary units.

Paleostructural isopaching coupled with standard isopaching of the sedimentary units has led to a more complete understanding of the depositional geometry and entrapping mechanism(s) of the pay interval (Zone A).

The Bacon Limestone of the Rodessa Formation is productive in a number of fields in DeSoto Parish and the surrounding areas. The techniques and strategies submitted in this paper may aid in the more successful development of existing plays and in the exploration for new fields.

INTRODUCTION

In 1977, Sun Oil Company purchased Nabors Drilling Company of Mansfield, Louisiana. An initial exploration/development program was initiated by R.B. Sullivan and William Burnett to evaluate the potential of the untested areas. One of their early wells was the Sun Lelong #2, which was completed in 1977 as a First Rodessa Porosity gas discovery.

Since the discovery well, 4 operators have drilled 13 Rodessa tests in the area with six resulting in completions in the First Rodessa Porosity. Sun has drilled nine of these 13 tests, with four being completed as First Rodessa Porosity gas wells.

The Rodessa Formation of Northwest Louisiana is a member of the Trinity Group of the Lower Cretaceous. Occupying the position between the base of the Ferry Lake Anhydrite and the top of the Bexar Shale, the Rodessa Formation is characterized by a series of interbedded limestones and micrites.

As defined by Sun, the First Rodessa Porosity falls just below the Kilpatrick Zone (where present) and immediately above the lower Anhydrite Stringer (L.A.S.) Present in well bores throughout DeSoto and the surrounding parishes, the First Rodessa Porosity varies from a biomicrite to a intrabiosparite (Choquette and Pray 1964), 5 to 25 ft (1.5 to 7.5 m) in gross thickness. In the study area (Figure 1), the First Rodessa Porosity is from 15 to 20 ft (4.5 to 6 m) in gross thickness containing from zero to 8 ft (2.5 m) net pay development. Where productive, the First Rodessa Porosity averages 12% porosity, 25% pore water and .75 md permeability by conventional core analysis. Unstimulated rates of production range from 20 mcf to 100 mcf with rates of 700 mcfgpd obtainable after suitable stimulation. Seven hundred fifty mmcfg recoverable reserves are estimated per well draining 320 acres.

[1]BarCo Exploration, Ltd., Shreveport, Louisiana 71101
[2]Student — Centenary College, Shreveport, Louisiana 71104

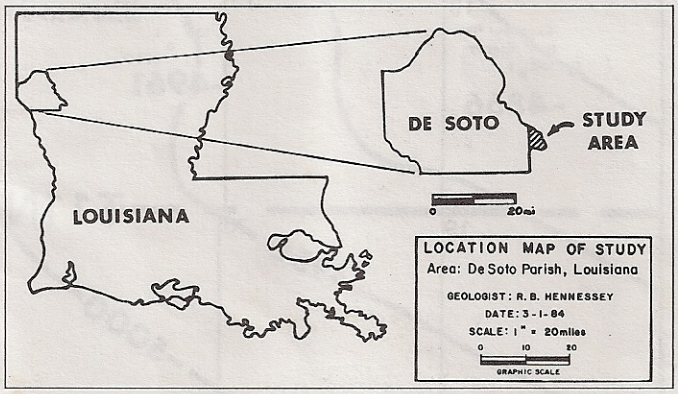

Figure 1. Location map of the study area in Eastern DeSoto Parish in Northwest Louisiana. Scale equals 20 mi (32 km).

METHODS

In early 1982, this work was initiated to formulate a development strategy for the First Rodessa Porosity in the study area. Although the methods put forth do not answer all of the questions raised by the play, it is believed this study has provided a more complete understanding of the trapping mechanism as well as a tool for the explorationist charged with discovering this type of trap.

As previously mentioned, Sun has drilled nine wells to date developing the first Rodessa Porosity in the study area (Figure 2). With few exceptions, Sun conventionally cored the First Rodessa Porosity and ran DIL-SFL-SONIC, Gamma-Ray-CNL-Density open hole logs. In addition to the data obtained from both the core analysis and the open hole logs, thin sections were cut from the Sun Lelong No.'s 14 and 16. After injection with blue epoxy resin, the thin sections were stained for carbonate (after Friedman 1959a) and studied under a petrographic microscope.

Marker beds above and below the First Rodessa Porosity which had continuity over the study area were identified in order to develop isopach maps of selective intervals.

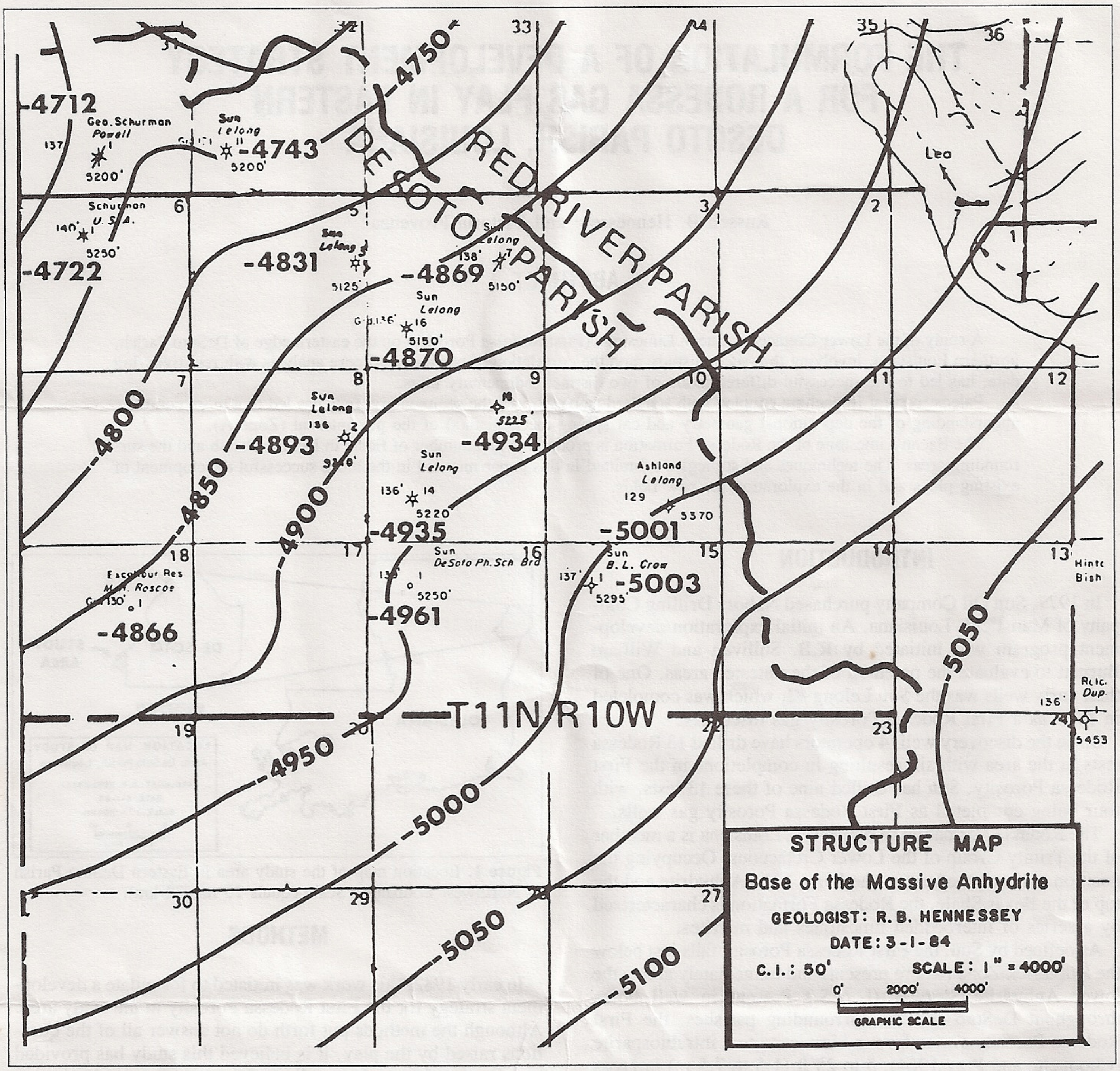

Figure 2. Structure map, Base of the Massive Anhydrite, in the study area. Scale equals 1 mi (1.6 km). Contour interval equals 50 ft (15 m).

LITHOLOGY

By close examination of the whole cores and coupling the core-gamma with the open hole logs, two distinct sedimentary units have been identified to make up the First Rodessa Porosity where the interval is gas productive (Figure 3).

Zone B, a buff to off-white colored biomicrite is present in all wells within the study area. Mistakenly identified as oolitic, the spherical to elliptical particles in the micritic matrix are orbiculina foraminifera. Measured porosities range from 3.0% to 6.5% with permeabilities <.01 md. Zone B is not found to be productive within the study area.

Zone A, a buff colored biointramicrite is the gas bearing interval of the First Rodessa Porosity in the study area. Zone A is composed of angular bivalve fragments 1.0-2.0 cm (.4-.8 in) in a cryptocrystaline matrix with occasional beds of well rounded intraclasts bound by anhydrite cement. Measured porosity valves of Zone A range from 7.5 to 14.4%.

Two kinds of porosity have been identified: primary microintercrystaline porosity and trace amount of primary (?) intraparticle porosity.

GEOLOGY

By selecting a marker bed directly above the First Rodessa Porosity and isopaching the various intervals desired from the marker bed to the different stratigraphic intervals which make up the First Rodessa Porosity, one can eliminate nearly all of

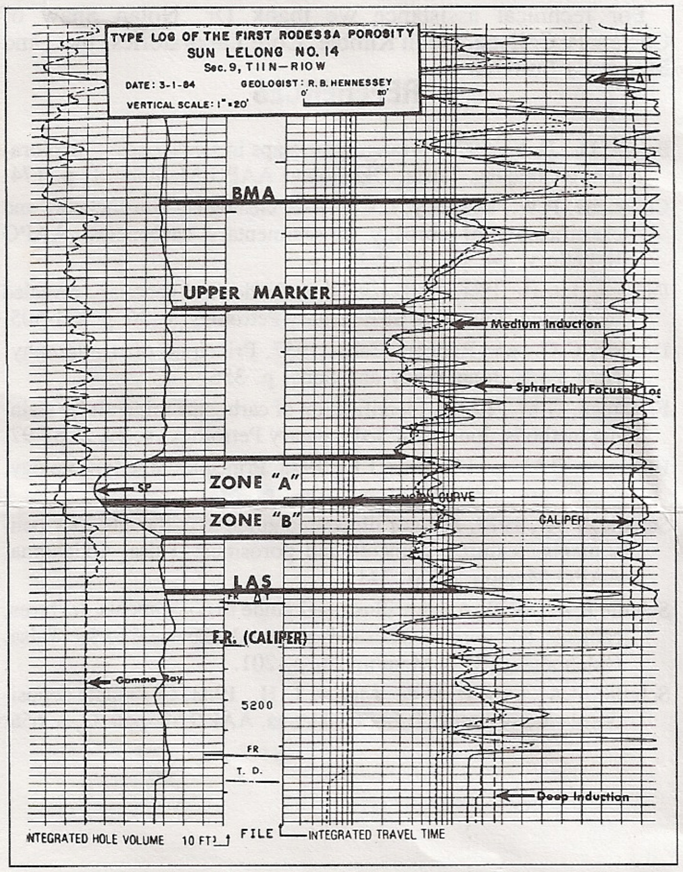

Figure 3. Type log (Sun Lelong #14) of the first Rodessa Porosity and the marker beds used for the various isopach intervals. Vertical scale equals 10 ft (3 m).

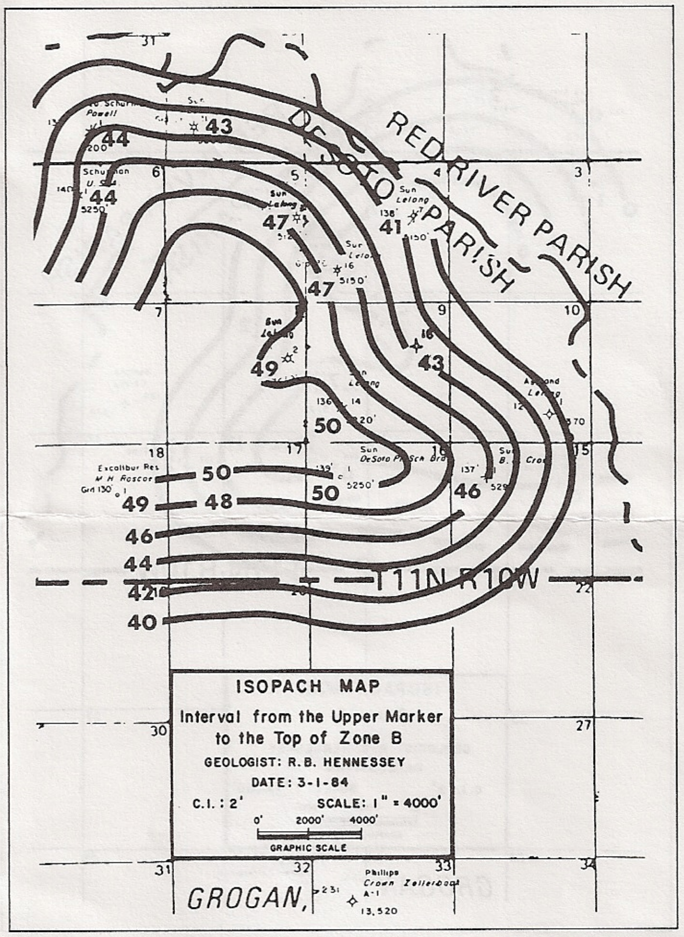

Figure 4. Isopach map of the interval from the upper marker to the top of Zone B. Scale equals 1 mi (1.6 km). Contour interval equals 2 ft (0.6 m).

the post depositional structural movements which may have affected the First Rodessa Porosity in the study area.

Figure 4 represents an isopach map from the upper marker to the top of Zone B (base of Zone A), and shows that the surface upon which Zone A (the gas bearing interval) was deposited was a gently sloping, semi-circular low, strikingly different from the present day subsea structure map (Figure 2).

Figure 5 is an isopach map of the net pay interval within Zone A. Note the direct correlation between Figures 4 and 5 in particular in the area of Lelong #2, 14, and 16.

It is evident from these maps that the paleotopography of Zone B controlled the accumulation of Zone A and hence the First Rodessa Porosity productive limits within the study area.

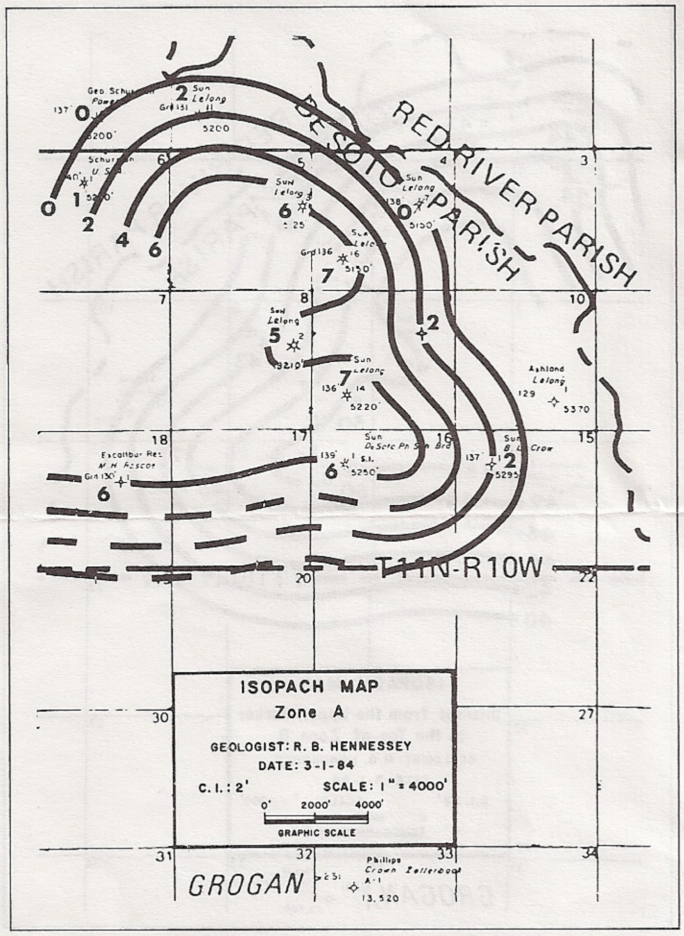

Figure 5. Isopach map of Zone A (see Figure 4). Scale equals 1 mi (1.6 km). Contour interval equals 2 ft (0.6 m).

CONCLUSION

1) The First Rodessa Porosity in Sun Exploration and Production Company's as yet un-named field in Eastern DeSoto Parish is a complex stratigraphic interval made up of two distinct intervals: Zones A & B.

2) Zone B, which is found in all well bores penetrating the First Rodessa Porosity within the study area, has been classified as a biomicrite. The surface topography of Zone B displays a semi-circular low within the study area. It is this low which controlled the depositional geometry of the overlying gas productive interval Zone A.

3) Zone A, the productive interval within the First Rodessa Porosity, has been classified as a biointramicrite. Two kinds of porosity have been identified and classified after Choquette and Pray 1970: primary microintercrystaline porosity and primary (?) intraparticle porosity.

4) Future development of this play and exploration for complex stratigraphic traps of this nature can gain valuable information from the selective isopaching technique put forth in this paper.

ACKNOWLEDGMENTS

The authors would like to thank Sun Exploration and Production Company for permission to sample the cores and for providing access to the data.

The play was discovered and initially developed by Mr. R.B. Sullivan and Mr. William Burnett, both of whom provided valued guidance and suggestions for this study.

For technical assistance we thank Dr. Nolan Shaw of Centenary College, Colin Kimble, Core Laboratories, Inc., and Mr. R.B. Sullivan.

REFERENCES

Busch, Dr. D.A., 1974, Stratigraphic traps in sandstones — exploration techniques. Tusla, Oklahoma, AAPG Memoir 21, p. 174.

Choquette, P.W., and Pray, L.C., 1970, Geological nomenclature and classification of porosity in sedimentary carbonates: AAPG Bulletin v. 54, p. 207-250.

Dickson, J.A.D., 1966, Carbonate identification and genesis as revealed by staining. Journal of Sedimentary Petrology, v. 36, p. 491-505.

Dunbar, C.O., and Rodgers, John, 1957, Principles of stratigraphy. New York, John Wiley and Sons, p. 356.

Friedman, G.M., 1959a, Identification of carbonate minerals by staining methods: Journal of Sedimentary Petrology, v. 29, p. 87-97.

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

Schulle, P.A., 1978, A color illustrated guide to carbonate rock constituents, textures, cements and porosities: Tulsa, Oklahoma, AAPG Memoir 27, p. 241.

Schulle P.A., 1979, A color illustrated guide to constituents, textures, cements, and porosities of sandstones and associated rocks: Tulsa, Oklahoma, AAPG Memoir 28, p. 201.

Schulle, P.A., Bebout, D.G., Moore, C.H., 1983, Carbonate depositional environments: Tulsa, Oklahoma, AAPG Memoir 33, p. 656.