[PS]Characterization of the Cretaceous "Olmos" Formation in the Somerset Oilfield, South Texas*

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Abstract

The Somerset Field is located within southwestern Bexar and northern Atascosa counties in south central Texas. This portion of the northeastern Maverick Basin has not been well studied. For over 100 years, the Upper Cretaceous Olmos Sandstone has been the primary target out of three separate producing zones. The primary structure of the region is the graben system of the Balcones-Luling-Mexia fault system, in which the Somerset Field lies partially within a southern half graben of the Luling Fault system.

There is conflict over the Olmos Formation being misnamed. It could possibly be the San Miguel Sandstone. Through core and well log analysis, a wave-modified fluvial deltaic and barrier bar system was identified. The sandstone is comprised of very fine-grained igneous grains and copious amounts of clay. The igneous clasts have been heavily altered and many of the original sedimentary structures, as well as permeability has been destroyed by bioturbation. The sandstone contains Skolithos, foraminifera, and aragonite oyster shells, as well as pyrite. The trapping mechanism is a combination structural-stratigraphic trap. The reservoir seal is that of the overlying Escondido shales, with the "Lit" zone possibly being part of the Olmos reservoir sand. With the data that has been analyzed, it is entirely possible that the Olmos Formation of the Somerset Oil Field is in reality the underlying San Miguel Sandstone, in a depositional setting that is analogous to the Texas Gulf coast of today.

Characterization of the Cretaceous "Olmos" Formation in the Somerset Oilfield, South Texas

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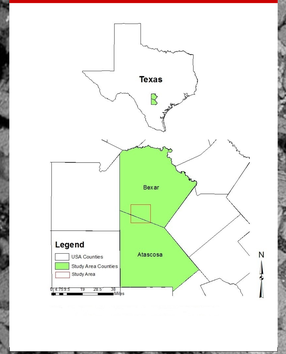
Location



Previous Work

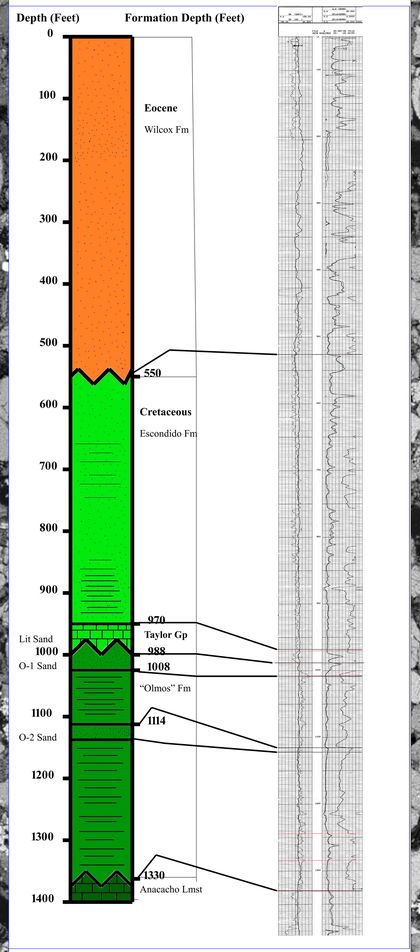
The Cretaceous Olmos Formation comprises the lower portion of the Navarro Group (Glover, 1955). The Olmos consists of both deltaic and coastal clastic sediments that were deposited during Gulfian time (Tyler and Ambrose, 1986). Coal beds, strand plains, and alluvial plains are found within the Olmos Formation (Tyler and Ambrose, 1986). These coastal and deltaic sediments comprise the Bigfoot Delta System.

Operators in the Somerset Oil Field call the upper Olmos Sand the o-1, while the second sand is called the o-2.

The San Miguel coarsens upward from silt to clay, and contain strand plains and barrier-islands (Weise, 1979). The San Miguel is wave dominated, and presents wave-dominated to wave-modified deltaic sequences that are truncated by successive transgressions (Weiss, 1979). The San Miguel is volcaniclastic, and has been highly bioturbated (Weise, 1979).

Structurally, the Somerset area is dominated by basinward dipping normal faulting of the Luling fault zone .The Luling Fault Zone (LFZ) is a parallel continuation of the Miocene aged Balcones- Luling- Mexia -Talco fault system (Walthall and Walper, 1967). This extension formed a primary graben, and numerous half-grabens, with the BFZ to the north, and the LFZ to the south (Maclay and Small, 1984). The LFZ is the result of post collisional extension along the Ouachita Orogenic Belt (Walthall and Walper, 1967).

Stratigraphic Column



Methods

Well logs were collected from The Post Cambrian Association, The Texas Rail Road Commission, Seagull Operating Company Inc., and Petrosaurus Inc. In all, a total of 298 well logs were collected from the Somerset Oil Field. The master well list was located, this list has over 15,000 wells listed in the Somerset Field.

These well logs were then organized by lease, and well number. The wells were located both by the Texas Rail Road Commission Database, and manually in the field. The locations of the wells that were collected in the field, are in NAD 83. This data was gathered by using a Trimble Juno GPS. The tops and thicknesses of the O-1 sand, and the Lit Limestone were picked, and recorded. The formations tops produce a very distinct gamma ray curve, which can be see in the stratigraphic column to the left.

Utilizing the well log data, isopach and structure contour maps were created., and analyzed.

Core was acquired from the Bureau of Economic Geology and Petrosaurus Inc. for analysis. The core will be correlated to the well logs. One well, the Bush #3 was thin sectioned, and carbon coated. It was analyzed with a polarizing binocular microscope, and the SEM in EDS. This will be utilized to describe the formation in question.

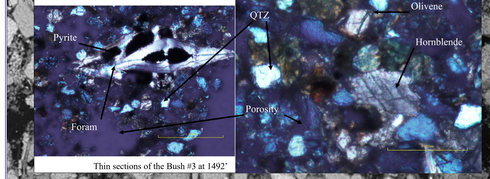
Extract characterization and x-ray diffraction was also conducted on the Bush #3 core, however the analysis proved too large for this particular project.

Stratigraphy


Aragonitic oyster shell, found in the Bush #3 at 1492'

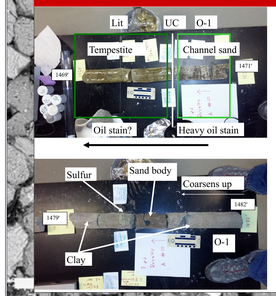
The "Olmos" sands are composed of heavily altered igneous sediments. Porosity is intergranular, with clay, calcite, and pyrite cement. Numerous small, aragonitic oyster shells are present, as well as *Inoceramus* shell casts and foraminifera.

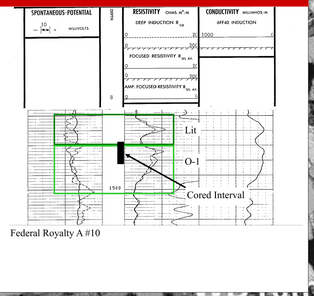
Bedding alternates between very fine sand and clay intervals, with sand bed thickness being 1 foot and coarsening upwards. This is interpreted as a meandering stream, cutting though lagoonal muds. Porosity is 22%, with permeability at around 80 md.



Thin sections of the Bush #3 at 1492'

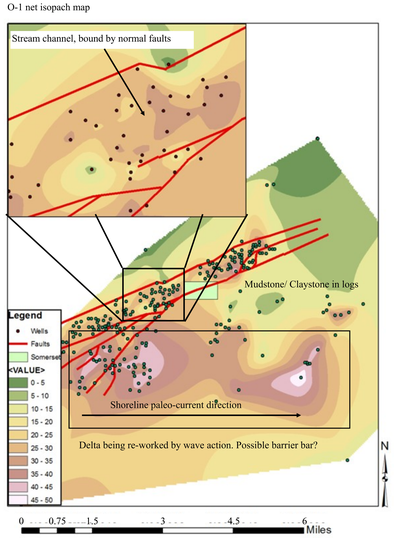
Core Analysis





Federal Royalty A #10

O-1 Isopach Map



Conclusions

The primary reservoir in the o-1 sand are 1-2 foot thick channel sands, that cut through lagoonal muds. The sands repeat several times, suggesting meandering action. The net isopach map shows the overall shape of the meandering river channel. This channel is bound by faults, suggesting that the graben portion of the field was tectonically active during deposition. Unfortunately, no core exists outside of the graben, that we know of.

The Lit, which unconformably tops the o-1 sand, is interpreted as a tempestite, with its very poor sorting and large shells scattered throughout. The boundary between the Lit and the o-1 has a very thin clay layer, which is believed to be a poor seal. This suggests that the perceived notion from operators, that the lit contains no oil, may be inaccurate. The Overlying Escondido shales would then be the primary seal. Invasion profiles, and a highly porous zone in the center of the Lit suggests this. The Gamma ray places a hot zone in the center of this porous area, there is no evidence as to why this occurs.

Thin section analysis indicates that the "Olmos" Formation in the Somerset Oil Field, may be the San Miguel sand. This is due to the large amount of volcaniclastics present. That and the river channel, entering a heavily re-worked delta is similar to what is described by Weiss (1979), of the San Miguel, farther west of Somerset.

Porosity is intergranular, with clay, calcite, and pyrite being cementing agents. Log porosity is around 22%, and core reports show a permeability of around 81 md, in the thin sands. The overall reservoir thickness is an accumulation of these thin sands, which can be resolved by the gamma ray log.

Somerset Re-Invigorated

I calculated the lit as to having a high OOIP per well, with virtually no water. There is a promising invasion profile, with a high porosity. Core has an oil stain, and mud logs note a shell filed sand, instead of shale reported by other operators.

With the evidence that the "Lit" may be reservoir, the operator suggested we test this hypothesis on a junk well that is going to be plugged. On a hot August morning, we met wireline and drove to the lease. We had two wells with only the state drilling records to show they exist. We proceeded to case-hole log , identify, and perforate our target. The two wells, we will call the #1 and #5, both showed strong evidence of success.

The #1 started to flow before the pump could be sent down hole. It is currently down due to "technical" issues.

The #5 absorbed water like a sponge, when we prepped for logging. With a perf gun malfunction, the tool was removed from the hole to be fixed, and was covered with water. After perforation, the tool came out dripping with light crude.

Thus far, the #5 has been pumping/flowing 8bopd and noticeable wet gas for the first week. This was a 1/8 bopd well. It produced the weekly production of the entire lease, in a day.

The #5 well on the first day of production testing. We filled the tank before lunch. 90-95% oil. (Below)

Acknowledgements

I would like to thank Tony and crew at Petrosaurus Inc., Robert and Crew at Seagull Operating Company Inc., My advisor Dr. David Rohr, for allowing me to create this project, the South Texas Geological Society, for awarding me the Jones-Ambsury Research Grant in 2015, and everyone else that was involved with this project.

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BEC 20kV WD10mmSS60 x40 500um
Sample
Nov 18, 2015
Background: SEM-Backscatter of the Bush #3, at1492'
Nov 18, 2015