

Geologists, Geophysicists and Engineers Energy and Mineral Advisors Since 1982

181 MARIOMI ROAD NEW CANAAN, CONNECTICUT USA 06840 PHONE: (203) 972-1130 FAX: (203) 972-6899 www.ammoniteresources.com

# CONFIDENTIAL

July 26, 2014 Via E-mail

ABC Energy Capital Ltd. Edinburgh, Scotland

# **Re:** Technical Review and Assessment of OKC Exploration Partners L.P. Mississippian Lime E&P Program in Kansas

Gentlemen;

ABC Energy Capital (ABC) requested on July 12<sup>th</sup> that Ammonite Resources (Ammonite) review the Mississippian Lime exploration and development program of OKC Exploration Partners L.P. (OKC) in south central Kansas. This letter summarizes our findings and recommendations.

The OKC E&P program in Kansas has not been successful after an investment of more than US\$180 million since 2010, and now a strategic business decision must be made as to the path forward. This memorandum summarizes Ammonite's review of the geotechnical and engineering aspects of the OKC Mississippian Lime program, and provides our assessment of the various options for the company. An independent reserve and economic analysis of the OKC Mississippian Lime program was not within the scope of Ammonite's engagement.

OKC has a competent technical team that has done a credible job at evaluating the Mississippian Lime play. However, the complex geology and high frequency of detected and undetected faults and fractures, together with the high intra-formational geological variability may preclude ever establishing repeatable horizontal success. Another negative factor affecting OKC's acreage is a low gas oil ratio (GOR) - 300 scf/bbl in Deer Path and 150 scf/bbl in Prairie - that provides a weak drive mechanism and results in low oil recovery efficiencies.

Ammonite recommends that no further horizontal drilling be conducted in the Mississippian Lime. There is the potential of drilling additional vertical Mississippian wells in favorable structural positions with demonstrated reservoir productivity, as well as some possible Simpson prospects. These wells will increase the PDP value of the company once drilled, but are unlikely to recover the capital invested to date. OKC is preparing exhibits for presentation to the board that quantify the value added of additional vertical drilling which may add incremental PDP value for an asset sale. However, it is Ammonite's opinion that a vertical exploration and development program is more suitable for a local small independent, and that the process of selling assets and winding up the company on the most favorable terms to shareholders should be initiated.

### Introduction

On July 18th, Ammonite's Skip Hobbs (geologist) and Lyndon Pittinger (petroleum engineer) met from 8:00 AM to 6:30 PM at the offices of OKC in Oklahoma City for a comprehensive geotechnical and engineering review of the company's Deer Path and Prairie OKC was represented by CEO Bob Rogers;\_\_\_\_\_, VP Land and Legal; project areas. \_\_\_\_\_, Evaluation Manager; \_\_\_\_\_\_, Operations Manager; \_\_\_\_\_\_, Drilling and Completions Manager; and \_\_\_\_\_, Senior Geologist. OKC provided a history of the company's entry into the Mississippian Lime Play in Kansas in 2010 and the rational for acquiring the acreage positions of \_\_\_\_\_ and then \_\_\_\_; reviewed the results of its drilling program to date; described the company's approach to geological and geophysical mapping, formation evaluation, petrophysics, and reserve estimation. The company's proprietary petrophysical and engineering work developed to better understand the Mississippian Lime and to try to overcome its challenges was described to us. Potential steps that could be taken to enhance existing production and drill new vertical and horizontal wells were also reviewed. Finally, the company discussed the options it has identified to either continue the development of its acreage position, sell assets, and/or wind the company down. Comprehensive documentation was provided to Ammonite, and all questions we asked were answered to our satisfaction. OKC was very frank in discussing the status of its exploration and production program, how results to date have not been successful, and the options that the company can pursue going forward.

OKC and ABC are now at decision point as to the future of the company. Should additional capital be expended in the hope that success will finally be found? Does the company's leasehold position hold any future promise for the Mississippian Lime or other reservoir objectives? Can the assets be sold? Should the company be liquidated?

#### Discussion

OKC has acquired a concentrated leasehold position in the Mississippian Lime Play principally in eastern Lime (Deer Path Project) and western Chert (Prairie Project) counties Kansas, on the west flank of the prominent geological feature known as the Central Kansas Uplift. The areas of interest had been proven to be "oily" by extensive vertical drilling over many decades to the Mississippian and deeper objectives, and was known to be geologically complex, highly faulted, and have very high water cuts and low GOR's. As described to us by Bob Rogers, the exploration thesis in 2010 when OKC entered the Mississippian play was to acquire a large leasehold position in the oily part of the Mississippian that was considered "under-explored" by modern technologies, and where leases could be obtained relatively cheaply ahead of the competitive industry "curve". It is our understanding that OKC and ABC saw the possibility of being able to acquire leases at a nominal cost per acre, and then to be able to farmout and/or flip the leasehold position at a significant acreage cost multiple as Chesapeake, Sandridge, Woolsey and others had done. According to Rogers, the OKC lease acquisition program was based on opportunity and not pursuant to a detailed geological analysis of a geologically complex play prior to executing the leasing program. This was the "fatal flaw" in our assessment.

As we understand from Bob Rogers, OKC was not able to "flip" or farmout its acreage to Chesapeake, Sandridge or other companies, and had to proceed with its own drilling program.

Most of the geoscience was done after the initial leases were acquired, and it is Ammonite's conclusion that OKC has done a good job in this regard with the "cards that it has been dealt". The purchase of the Drillco checkerboard acreage in Lime County was justified, as was the subsequent purchase of the Oilco acreage, prior to testing the Deer Path and Prairie project areas with horizontal wells. It is not Ammonite's intent to review or second guess the OKC drilling results on a well by well basis. The results speak for themselves, and they are not commercially viable. OKC has a competent geosciences and engineering team, and applied appropriate geological, geophysical and engineering technologies to evaluate and drill its project areas.

OKC has drilled a total of 35 vertical and horizontal wells. Current production is 290 BOPD. The following table<sup>1</sup> provides a reserve, estimated ultimate recovery (EUR) and well count summary for the Deer Path and Prairie areas. With \$112 MM of capital spent on Deer Path, and 618.6 MBO EUR (normalized to a full lateral), the overall finding and development (F&D) cost is \$181/bbl. On a per well basis, the EUR averages 48.7 MBO/well for 11 horizontal completions and 5.2 MBO/well for 16 vertical completions. For Prairie, the overall F&D cost is \$189/bbl (\$50 MM/264.1 MBO), and per well recovery averaged 33 MBO/well for 8 completions. These figures do not include the capital required to complete the remaining half of lateral sections. Only one well, Blitzer 4H, has the potential to exceed OKC's targeted horizontal type well of 150 MBO. Given the complexity of the geology, OKC's management and technical

<sup>&</sup>lt;sup>1</sup> From handout provided by OKC.

team currently recommends no additional investment in horizontal completions in either area, with Ammonite's concurrence.

### **TABLE DELETED**

So why has the drilling program been a failure? High water inflows and very low oil cuts due to communication of the horizontal wellbores to water inflows from faults and fractures and water saturated reservoirs and/or carrier beds is the principal reason. OKC did not present a regional geological analysis. However, we believe that the location of OKC's Deer Path and Prairie leasehold positions on the highly faulted and fractured western flank of the Central Kansas Uplift explains the high frequency of water bearing faults and fractures. In most unconventional plays, longer laterals are generally better for recovery, but in this area, a longer lateral has a higher risk of hitting a geologic hazard that allows excessive water production. In the Prairie project area, the absence of confining shale barriers to hydraulic fracture propagation is resulting in connection with the wet Mississippian Osage Chert reservoir and/or the wet Arbuckle Formation. Faults, fractures, lack of confining units and wet reservoirs constitute geologic hazards to drilling.

As an attempt to mitigate drilling risk, OKC has developed what they call the "Matrix System" to high-grade well site locations. The selection criteria include location on: 1) a structural high; 2) offset to favorable proven vertical production; 3) the absence of faults as indicated by 3D seismic; 4) a petrophysical evaluation that indicates favorable permeability to oil flow; and 5) a volumetric model that indicates greater than 150,000 barrel oil EUR. The methodology makes good sense.

OKC has applied a number of applicable processing algorithms, such as azimuthal attributes, coherence and curvature, to its 3D surveys to identify the location of geological hazards, and has used these data to define "safe" drilling locations. OKC has also done an admirable job in developing a neural network petrophysical methodology to differentiate flow units and better define reservoir quality. This method identifies facies type and applies log analysis parameters appropriate for each facies.

Because of the high geological variability and inability to image small faults and fractures, the Matrix approach, however, has not been successful, as indicated by the Schmidt well, for example.

A horizontal well could be justified as an offset to the Blitzer well in the Johnson area of the Deer Path Project, where OKC has mapped a prospective area of some 981 acres. However, OKC has reached a point where it is now reluctant to drill additional horizontal wells for fear of running into unseen geological hazards, and getting poor results from wells that on a pre-drill basis appear to be technically justified.

OKC's evaluation manager believes that 90% or more of the company's leasehold position is exposed to potential geological hazards as evidenced from the company's 3D seismic surveys and geological mapping. We looked at some of the 3D seismic and concur that there is indeed a very high risk of encountering geologic hazards.

As OKC's drilling has indicated, the Mississippian well results have not been predictable nor repeatable due to the variable geology, as well as faulting. OKC's evaluation team commented that "this play will make you lose your mind" and that the "play makes us uncomfortable as we cannot measure and predict results." There is an explanation. The Mississippian "Lime" consists of a number of stratigraphic and lithological sub-units and reservoir objectives inclusive of the Chat, Tripolitic Chert, Dolomite, and Dense Lime. Each unit is highly variable in thickness and quality, and must be mapped and evaluated independently. Because each zone has different petrophysical and mechanical properties, it requires a different completion process. Each operator has to move up a petrophysical analytical and completion "learning curve" in each local area of operations. There is no broad regional standard "formula" for completions or EUR.

Due to the location of the OKC land position on the flanks of the Central Kansas Uplift, the region was subjected during the Mississippian period to multiple episodes of uplift and subsidence resulting in highly variable intra-formational localized depositional environments, erosion and diagenesis (chemical alteration). Unit thickness varies widely due to original deposition and the presence of numerous intra-formational unconformities (erosional truncation surfaces). This explains why it has been so difficult if not impossible for OKC to repeat offset well results. The side-track of the Mitchell well for example, while only a few tens of feet away from the original wellbore, had completely different results.

The lower relative permeability of oil to water is another challenge facing OKC. This is exacerbated by the very high water cut, low GOR and under-pressured nature of the productive reservoirs in the OKC leasehold. Although the petrophysical data indicate acceptable reservoir oil saturations, the low permeability of oil relative to water is resulting in very low recovery of the log-measured oil in place.

#### **EUR per Well**

OKC's type well of 150 MBO per well for a horizontal completion appears to be based on Netherland Sewell's type well prepared for SandRidge, but reduced by 18%. OKC presented an alternative volumetric model based on assumptions for drainage area, thickness, porosity and recovery efficiency that was consistent with the EUR of 150 MBO. J.P. Dick, with Pinnacle Energy Services, is a prominent petroleum engineering consultant working on the Mississippi Lime play, and his presentation dated October 31,  $2012^2$  shows EUR averages 90.8 MBO and 793 MMscf (GOR = 8,700 scf/bbl) for 615 horizontal wells across the entire Mississippian play based on decline curve analysis. Most of the wells in this study are in the Alfalfa, Grant and Woods Counties of Oklahoma, considered by SandRidge to be the core area of the Mississippian play. The GOR of these wells averages 8,700 scf/bbl, which provides substantially more energy for expansion and flow through solution gas drive than the lower GOR oil in the Deer Path and Prairie areas. The GOR in Deer Path is 300 scf/bbl, and in Prairie 150 scf/bbl: with such low GOR values, fluid recovery is driven only by fluid expansion. Recovery efficiencies can be several times greater with solution gas drive than fluid expansion. In the Eagle Ford and Utica unconventional plays, oil EUR values tend to decline steeply as GOR values fall below 1,000 scf/bbl<sup>3</sup> indicating low GOR values have a significant negative impact on oil recovery in tight, unconventional plays.

It is unclear to Ammonite why OKC's Type well would have an EUR 65% greater than the average well in the play knowing OKC's wells have a less effective drive mechanism and likely to have a much lower recovery efficiency. For example, OKC's EUR estimates<sup>4</sup> for the Pettigrew and Rutter prospect areas using the recently developed Matrix process are roughly three times the play average of 90.8 MBO, despite the typical well in the play having a much more effective drive mechanism affecting recovery efficiency. J.P. Dick's work was referenced several times during the July 18<sup>th</sup> meeting, so OKC should have been aware of his findings. Ammonite cannot explain why OKC's type well would be much more optimistic than the main area of the Mississippian play yet have such an unfavorable characteristic as a low GOR.

Another concern Ammonite has with OKC's EUR estimates is how they normalize volumes to full lateral length. OKC has typically stimulated and completed only 50% of the length of the horizontal section. In some of its EUR estimates, it assumes that the well EUR is double the estimated recovery of the half-lateral section. This is potentially optimistic because it assumes production from one-half of the well completed first does not interfere with delayed production from the other half. Given that most of the Mississippi Lime intervals are already naturally fractured, the drainage area of half of a lateral is likely to extend beyond the induced fractures and partially overlap with the drainage area of other half of the lateral, causing some degree of interference. In addition, a longer completion interval runs a greater risk of encountering a geologic water hazard such as a fault that could negatively affect the entire well by substantially lowering its oil cut.

<sup>&</sup>lt;sup>2</sup> Dick, J.P., (2012), "The Unconventional Mississippian Play Early Producing and Completion Statistics (& Observations)", Mississippian and Arbuckle Workshop, Oklahoma Geological Survey, October 31.

<sup>&</sup>lt;sup>3</sup> Based on decline curve analysis of publicly reported data provided by HPDI (unpublished work by Pittinger).

<sup>&</sup>lt;sup>4</sup> Pages 39-41, "Horizontal Summary", date not provided.

### Future Drilling Locations in the Deer Path Project Area.

As described earlier, OKC is reluctant to drill any further horizontal wells in the Deer Path Project area. They believe that five to eight vertical wells could be drilled on the Matrix rated structural high in what they call the Johnson Area, where the Blitzer and Howell wells were drilled and completed. OKC estimates an unrisked expected average EUR for the vertical wells of 30,000 BO. The vertical wells are less likely to communicate with water bearing zones, and if a water zone is encountered, there is a better chance that it can be sealed off. Additional vertical wells would add additional PDP reserves. OKC did not present and does not appear to have any other areas it is recommending for further vertical drilling to Mississippian objectives in the Deer Path project area. There is thus very limited room to grow operations in the Deer Path leasehold.

As a result of a 125 BOPD with no water Simpson discovery made this year by Ford Energy in Lime County, OKC has evaluated the Simpson potential in its leasehold. Senior Geologist \_\_\_\_\_\_ reviewed his Simpson Formation prospect inventory with Skip Hobbs. The Simpson prospects are very low relief structural and stratigraphic closures with a seismic signature that is similar to producing analogues. They appear on a quick look basis to have geological merit. However, some of the prospects are on leases that have already expired, and would have to be released if OKC were to pursue a Simpson drilling program.

## Future Drilling Opportunities in Prairie Project Area.

In the Prairie Project area OKC has mapped a vertical PUD location to the Smith 2A well. The company has also identified on seismic three small closed structural highs with potential for multiple vertical Mississippian Dolomite wells on 20-acre spacing with average unrisked 25-30 Mbo/well potential – these are the Robin, Bobwhite and Sparrow prospects. The risk of poor porosity development in the Dolomite is high.

The Cheddar Sand has been a good producer regionally from very low relief structures and stratigraphic traps and is considered a mature play. OKC drilled a Cheddar Sand prospect successfully with the Sanchez 12H horizontal well in the Prairie Project area. The Sanchez is interesting geologically, and appears to be on a production incline, suggesting oil migration from another reservoir. Geologist \_\_\_\_\_\_ believes that the Sanchez well is probably not repeatable as a horizontal well. There is likely additional vertical Cheddar potential.

OKC has mapped some potential Hunton/Viola prospects in the Prairie Project area. The best Hunton prospect was tested with the White 12-12 well and was unsuccessful, in part due to a

seismic velocity problem. Ammonite ranks the remaining Hunton prospects as very high risk and does not recommend drilling any further Hunton objectives in the Prairie area. Geologist \_\_\_\_\_, who is closest to the Hunton technically, also recommends that no further Hunton prospects be pursued.

If any additional wells are to be drilled in the Prairie area, a vertical offset to the Petrie well is the only one we can recommend at this time.

# **Next Steps**

OKC has not "cracked the code" in making the Mississippian Lime a commercially viable target in the company's areas of operation despite good quality geoscience and operational engineering practices. The location of OKC's Deer Path and Prairie leasehold positions on the highly faulted and fractured western flank of the Central Kansas Uplift may preclude ever establishing repeatable horizontal success. Operations in reservoirs with very high water cut has also presented the company with the challenge of the low permeability of oil relative to water in fractured reservoirs resulting in very low recovery of the log-measured oil in place.

OKC management and technical staff recognize that the company's exploration program has not been successful, and that the likely outcome will be a sale of assets and winding down of the company. Bob Rogers emphasized that they want to do what is best for the shareholders and try to add value to minimize the financial loss. We sensed that morale is low and everyone believes it is "time to move on". The company geophysicist and lead petrophysicist – the person who developed the neural network evaluation program for the Deer Path Project, have already resigned. Bob would like to keep the core team together for the "next project".

The company has defined four options. These include 1) immediate liquidation; 2) formal liquidation; 3) vertical drilling and sale; and 4) horizontal farmout and sale. These options are being documented as to the cost/benefit of each option, and a formal presentation will soon be made to the OKC board.

It is Ammonite's assessment that the potential for further horizontal drilling of the Mississippian Lime is very limited in both the Deer Path and Prairie prospect areas. We do not recommend further horizontal drilling activity at this time.

OKC has outlined a program to drill some vertical Mississippian wells in the "Matrix" high-graded areas to enhance PDP value. Ammonite has not independently analyzed the value added through recompletions, but it is an option where the proposed operations have geologic merit and should be considered. Our view is that the existing production on structurally high prospect areas with considerable offset potential - at least vertically, and the Simpson prospects and leads, and the concentrated acreage position, should be of interest to local operators.

Additional vertical wells could be drilled to the Mississippian in the Prairie area where the Jones and White wells were drilled, and the vertical Simpson and Cheddar prospects are viable. OKC estimates potential unrisked EUR volumes of 30 MBO per vertical well at a cost of 600 M per well completed (incremental F&D = 20/bbl). If one well in the program encounters a water hazard, that well can be abandoned at a fraction of the cost of a completed well and other successful wells are unaffected. In contrast, encountering one water hazard in a horizontal well damages the potential recovery of the entire well. Hence, vertical wells reduce the water hazard risk when the geology presents hazards that are highly variable and unpredictable. However, it is Ammonite's opinion that this vertical activity is more suitable for a small Midcontinent independent than a company financed by ABC, and will not result in recovery of the capital expended to date even if successful.

Ammonite recommends that OKC pursue the option of farming out its leasehold position to a company that believes it can successfully produce the Mississippian Lime, but at the same time also consider an orderly sale of the producing assets and infrastructure assets and winding down OKC. There is a limited universe of large companies that are likely to consider an entry into the Mississippian Lime given the exit of companies like Shell, Apache, Encana and others from the Kansas portion of the play. The smaller companies are not likely to pay much up-front cash for the exploration acreage, but there are buyers for the production and offsetting acreage prospective for vertical well development, and the Simpson prospects.

If \_\_\_\_\_\_ decides not to pursue a farmin or acquisition, then OKC should consider dividing up its leasehold position, producing wells and prospective acreage into a number of defined project areas, and put them up for auction through organizations such as Oil & Gas Asset Clearinghouse and EnergyNet.com. However, OKC and ABC must decide whether a delay in the sale is warranted given the recent drop in oil prices. It might make sense to drill some of the best vertical well locations to enhance PDP value in the expectation that oil prices might rise again in six months to a year.

Please call us should you have any questions about our conclusions and recommendations.

Respectfully yours,

G. Warfield Hobbs

Lyndon Pittinger