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Reviving an Abandoned Exploration Well in an Algerian Low Permeability Natural Gas Prospect Through Hydraulic Fracture Stimulation

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SUMMARY

In Algeria, there has been in recent years a strong push to increase the natural gas production. This has led to a drive for exploration success in the vast low permeability natural gas basins of the Southeastern Saharan Desert province in the country.

In Algeria, there has been in recent years a strong push to increase the natural gas production. This has led to a drive for exploration success in the vast low permeability natural gas basins of the Southeastern Saharan Desert province in the country. Traditionally, operators in these tight gas exploration plays have focused their efforts on determining the hydrocarbon in place resource (static) rather than the hydrocarbon productivity (dynamic). In many instances, this has led to the estimation of a large resource-in-place, which later turns out to be seemingly uneconomic to produce at commercial flowrates and drawdown pressures. For many years, wells drilled in these potential reservoirs were abandoned upon a negative test or low flowrates to surface.

Proving the commercial productivity of these potential reservoirs is quite complex. Typically these reservoirs are producing from very old Cambro-Ordovician age rocks which are quartz rich, naturally fractured, and vertically and laterally extensive with net thicknesses of more than one hundred meters being quite common. The very low effective porosity of from three to eight percent, with concurrent low permeability in the micro-darcy range, and often poor hydraulic fracture containment due to low stress heterogeneity, leads to further challenges. Additionally, rugose hole conditions are common in these areas, which reduces the reliability of the wireline logging measurements. Natural fractures play an important role in productivity, too, but are hard to detect due to these hole conditions; however, a good characterization of these natural fracture is very important for understanding the productive potential.

As new technology including advanced formation characterization for natural fractures detection, geomechanical stress modeling, low-damage fracturing fluids, and advanced pressure diagnostics has become available, these technologies are now being applied in these Algerian low permeability natural gas prospects to prove economic producibility and reserves to allow successful development of this resource. This paper will illustrate the case of a particular exploration well, one among many, which was scheduled for abandonment after a no-flow to surface with an open-hole DST was recorded. Through a re-evaluation and re-processing of the wireline logging data, including identifying natural fractures, calibrating a geomechanical model for the well, reviewing the testing procedures, and designing and executing a hydraulic fracture stimulation program for the well, economic flowrates of 8 mmscfd were realized allowing this well scheduled for abandonment to instead now be classified as an exploration success/discovery and drive further appraisal well efforts in the area.

This success is now causing many other “abandoned” exploratory wells in the northern African basins to now be re-evaluated and re-entered via application of a suite of tools including advanced hydraulic fracture stimulation technology to turn an exploration failure into a success, and thus further driving the low permeability market growth in Algerian gas basins.