

A Large Unconventional Gas Condensate Discovery in the Ordovician Tight Sands of Central Saudi Arabia

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ABSTRACT

Over the last 45 years, 3 exploration wells penetrated and tested the deep, Ordovician tight sands of a structure in central Saudi Arabia. In 1972, a very successful exploration well targeting shallow Jurassic oil was drilled deep into the Ordovician and tested a small amount of gas at surface after an open hole drill stem test. The final flowing well head pressure was 100 psi more than the initial flowing well head pressure suggesting the well may be cleaning up. With the success of the up-hole oil field discovery, a second well was not drilled deep into the Ordovician until 2004 when a cased hole drill stem test recovered water, contrary to the petrophysical log response. In 2007 a Permian gas exploration well was deepened to the Ordovician and a cased hole drill stem test recovered gas and condensate at a low flowing well head pressure and declining rates. In 2015, an appraisal program to determine the deliverability, areal extent, concentration and repeatability of the Ordovician was initiated over the entire structure. The horizontal discovery well in the north-central part of the structure had 3000 feet of effective lateral length and 13 frac stages and delivered significant amounts of gas and condensate at a very robust stabilized flowing well head pressure. Two more wells were drilled in 2016 as a continuation of the appraisal program. A vertical well was drilled at the south end of the structure and flowed at similarly high gas and condensate rates with a stout flowing well head pressure. At the north end of the structure, a horizontal well was drilled with 3500 feet of effective lateral length and 9 frac stages which flowed large amounts of volatile oil and gas. The discovery well and the two appraisal wells at the south and north ends of the field, indorsed the identification of several key reservoir complexities. Stratigraphically, the reservoir zone in the South is in the Lower Ordovician, whereas the reservoir in the north is in the Upper Ordovician. Across the field isotube Ethane/Deuterium isotopic gas analysis suggests the overlying Silurian shale source rock gas is less mature than the gas sampled in the Ordovician reservoir signifying multiple sources. Gas condensate ratios and C6+ percentages increase from south to north across the field contributing to surface production facility complexity.