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An Explanation for the Gas Oil Ratio Variation Among Central Arabian Petroleum

Oil and gas condensates throughout central Saudi Arabia exhibit unusually high variation in gas-oil ratios (GORs). For example, there are condensate fields that have GORs in the 10,000s scft/bbl range, whereas there are nearby oil fields with GOR values well below 150 scft/bbl. At one of the largest fields, an order of magnitude range in GORs is exhibited (150-1490 scft/bbl). In addition, many of the oils are extremely undersaturated with gas, despite having gravities in the range of 44° to 47° API units.

This undersaturation could not have taken place merely through the loss of gas by diffusion or cap rock leakage, because the remaining oil would remain near saturation. Further, a converse mechanism, whereby gas is being added to reservoirs and the GOR is currently rising, does not explain the present situation of severe undersaturation. It is highly unusual, on a global basis, for oils of 42° (and higher) API gravity to be so severely undersaturated.

Assessment of independently measured parameters used to address water washing of crude oils has shown a strong relationship between water washing and GOR. GOR is the lowest in the most water-washed oils. These findings lend critical support to the theory that the GOR of central Saudi Arabian oils and condensates is controlled to a major degree by water washing, although other mechanisms will be discussed. The implications for Exploration and Production are that the ability to account for the distribution of GORs can (1) lead exploration to exploit targets with GORs fitting the company's objectives, and (2) lead engineers to plan critical infrastructure and handling facilities with advance notice.