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**Gas Isotope Assessment of the Unconventional Paleozoic Petroleum System in NW Saudi Arabia**

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With the recent advent and successful exploitation of unconventional gas resources in the USA, efforts are underway to assess the unconventional Paleozoic petroleum systems in NW Saudi Arabia. To date, this region has seen limited exploration with prior efforts targeting conventional gas likely to have originated from the extensive, generally TOC-rich shales from the Silurian Qusaiba Member of the Qalibah Formation. Recent efforts now focus on the region's unconventional gas potential and with less than ten geological structures drilled in an area the size of Oklahoma much remains in terms of understanding the petroleum system. Using Mud Gas Isotope Logging to characterize all subsurface gases, a new detailed petroleum system assessment has been undertaken.

Mud Gas Isotope Logging, a technique involving analysis of the carbon isotopic composition of methane, ethane, and propane from circulating mud gas streams during drilling, has found considerable application in global hydrocarbon exploration and production operations. Drilling economics prohibit completely testing and assessing all possible subsurface hydrocarbon-bearing strata, resulting in testing of only a small number of selected targets based on available knowledge, mud logs and other ancillary pieces of information. Although most down-hole logging technologies provide detailed knowledge of the subsurface, there are geologically important questions that cannot be fully addressed even with the most advanced formation evaluation tools, such as validation of hydrocarbon-charged intervals, assessment of sealing intervals, charge history, source rock characterization and thermal maturity of hydrocarbons. For unconventional gas resource plays these types of data are among the most important.