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Novel Pyrolytic Methods to Characterize Oil Reservoirs with Optimized Delivery in Real-Time at the Wellsite

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Novel pyrolytic methods developed by Saudi Aramco to quantitatively assess reservoir quality from residual hydrocarbon staining on drill cuttings have been applied in “real-time” to assist with geosteering horizontal oilfield development wells. The subject methods include: the Pyrolytic Oil-Productivity Index (POPI), the Apparent Water Saturation (ASW) Method, the Compositional Modeling Method (CoMod), and the Volume of Organic Matter Method. The patented methods, known collectively as POPI Technology, provide the assessment of oil quality, reservoir productivity, water saturation, and tar identification and quantification.

Most wellsite logging tools provide an indirect assessment of the rock properties, pore system, and fluid properties in a reservoir. Pyrolytic methods provide a direct assessment of the residual hydrocarbons present on rock samples and can be used to assess connectivity with the active fluid system in the reservoir. Results from pyrolysis have shown a close relationship to results from well logs, core data, and dynamic test data. POPI instrumentation and methods can accurately quantify tar volumes over a wide range of concentrations, and are routinely applied to drilled cuttings in real-time at the wellsite to assist in geosteering horizontal development wells. POPI data are integrated with other well data to confirm correct well placement early in the drilling process. This provides better success in meeting well design objectives while reducing lost rig time for unnecessary testing, or the drilling of additional side-track wells.

Saudi Aramco has exploited this technology in the Kingdom through the commercialization of services, which to date, have been provided in real-time at over 130 horizontal wells and over 350 wells including laboratory studies. A recent milestone in commercializing POPI Technology was achieved with the development of an advanced geochemical analysis and modeling application known as GC-ROX – Geochemical Residual Oil eXpert. GC-ROX is a first of a kind software that integrates all aspects for data validation, organization, calibration, modeling, calculation, visualization, interpretation, integration with other data sources, and results delivery. The software accomplishes the delivery of high-level geochemical interpretations in “real-time,” at the well site, by field personnel and can interface directly with real-time data servers, exchanging data via the industry standard WITSML protocol. GC-ROX has provided the solution to achieve a fully commercial application of our in-house developed technology.