Chronostratigraphic Controls on Clay Mineralogy in the Early Silurian Qusaiba Source Rocks, Saudi Arabia

Shaun Hayton[1] and Hartmut Jaeger[2]

[1]Geology Technology Team, EXPEC - Advanced Research Center, Saudi Aramco, Dhahran, Saudi Arabia.
[2]GeoResources STC, Heidelberg, Germany.

ABSTRACT

Two new clay composition constraints for the lower section of the Qusaiba Member of the Qalibah Formation have been identified. These constraints will have significant impact on the petrophysical analysis result of the lower Qusaiba Member and associated organic-rich source rocks. The regionally extensive organic-rich shales within the lower section of the Early Silurian Qusaiba Member of the Qalibah Formation are believed to have been the principal source for much of the Paleozoic petroleum system. More recently they have been the focus of increased attention as a potential unconventional organic-rich shale play, especially in northern Saudi Arabia. With the recent development of a chronostratigraphic framework for the lower Qusaiba (Hayton et al. in press) it is now possible to compare widely spaced samples on a consistent time and lithostratigraphic and/or paleoenvironmental basis. Detailed petrophysical assessment of the Qusaiba source rocks in support of unconventional resource assessment has been problematic, in part, due to a lack of understanding related to the mineralogy of these fine-grained shales. Various studies have recently been completed or are underway to try and resolve some of the underlying uncertainty. As a part of these studies the clay mineralogy of 47 samples from 8 wells spread across the Kingdom was analyzed and compared to the recently developed chronostratigraphy for the lower Qusaiba in northern Saudi Arabia. By placing the results of the quantitative clay mineralogy into the chronostratigraphic framework, two new clay compositional constraints were identified. These two new constraints provide the fractional volumes of illite/smectite, illite/muscovite within the total clay fraction. In both cases a distinct “Rhuddanian” trend can be identified that is very different from the “general” trend. Hayton, S., Rees, A. J., Vecoli, M., in press: A punctuated Late Ordovician and early Silurian deglaciation and transgression: Evidence from the subsurface of northern Saudi Arabia. American Association of Petroleum Geologists Bulletin.