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Oil Characterisation in Heavy Oil Systems

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ABSTRACT

Oil characterization has traditionally been focused around organic geochemical techniques, such as biomarker analysis. However, here we describe the use of inorganic elemental geochemistry by ICP-MS and ICP-OES analysis to provide high-resolution compositional characterization of heavy oils.

Detailed evaluation of the chemical composition of heavy oil accumulations provides critical information regarding the temporal and spatial controls on their formation. Obtaining a high-resolution compositional understanding of the oils allows us to observe changes in the characteristics of the oils throughout the well. The behavior of concentrations of some of the key metals, such as Ni and V, enable changes in asphaltene concentration to be observed. This in turn allows assessments to be made regarding changes in oil viscosity and API gravity within the well. This technique is particularly valuable in plays where tar mats pose a significant production problem. Tar mats are notoriously difficult to identify in the sub-surface, as traditional petro-physical methods are unable to determine the transition from heavy oils to the tar mat phase. However, tar mats are characterized by exceptionally high concentrations of organo-metals, and as such oil compositional data can be used to identify and highlight the presence of tar mats within a play.

Elemental analysis of heavy oils also enables us to conduct oil-oil correlation, which in turn provides valuable insight into the assessment of reservoir connectivity. In addition, the identification of chemical trends within the oil column provides a valuable tool for multi-well scale correlations and the correlation of produced fluids to oil column horizons. Inorganic analysis of oils can be conducted on fluids, formation waters and heavy oils extracted from oil sands core, making its application ideal to heavy oil systems.